

**ANNUAL ADMINISTRATIVE REPORT (FY 2003) AND
WORK PLAN (FY 2004) FOR
INVENTORIES AND VITAL SIGNS MONITORING
FY 2003-FY 2004**

GREATER YELLOWSTONE NETWORK

Includes: Yellowstone National Park, Grand Teton National Park, John D. Rockefeller, Jr. Memorial Parkway and Bighorn Canyon National Recreation Area

Greater Yellowstone Network Approval Signatures

Darrell Cook, Superintendent, Bighorn Canyon National Recreation Area Chair, Board of Directors	Date
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Tom Olliff, Chief of Resources, Yellowstone National Park Chair, Technical Committee	Date
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Cathie Jean, Program Manager, Greater Yellowstone Network	Date
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Bruce Bingham, Intermountain I&M Coordinator, FY04	Date
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Mike Britten, Intermountain I&M Coordinator, FY03	Date
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	Budget program (MS Access, aarwp_budget.mdb)
97	Which version of Access did you use? [Enter 97 or XP for Access 97 or Access XP at the beginning of this line.]
√	The income amounts entered for Biological Inventories, Vital Signs Monitoring, Prototype \$\$ - Annual Transfer, Water Quality Monitoring and other sources matches the dollar amounts from the memos sent to the regions/networks by WASO (have you used the correct income amounts?).
√	In the Add/Edit Budget Records form, the amount shown for Total Expenses matches that for Total Income. (If it doesn't, enter a record under Expenses in the 7_Other category to make it balance; use an entry such as 'Unexpended funds' or 'Overspent Funds' in the Description column to explain the amount.)
√	For all Expense records, the Description field includes the name of the university, agency, company, or other vendor to help us document our outsourcing efforts. (If this expense involved a contract, cooperative agreement, interagency agreement, or other partnership, is it clear where the money went?)
√	For all Expense records, the correct item from the picklist for 'Where \$\$ Went' has been entered. [Think about who the check was written to; e.g., enter 'Other Non-Federal' for funding that went directly to the private sector, such as for purchases (computers, supplies, etc.), travel (airlines, rental cars, hotels).]
√	On the Status of Biological Inventories form, there is one record for each inventory that is described in the text section of the AARWP or the budget program for FY 2000-2003 (data should be included for previous years since this is our first year of building this database). Be sure to list each park that was involved in the particular inventory.
√	Each year's budget has been exported as an .rtf file (one for FY 2003 and one for FY 2004), and both files have been inserted into MS Word at the end of the AARWP document.
√	The file aarwp_budget.mdb has been renamed to include the 4-character network alpha code and the years, as shown in this example: NCCN_FY0304_aarwp.mdb
	Annual Report and Work Plan (MS Word)
√	I have carefully read the guidance for the AARWP and followed it.
√	A header or footer with the date that the aarwp was last revised has been included.
√	I gave special attention to the 'Public Interest Highlights' and 'Major Accomplishments' sections of the report. (We need good examples of the successes, applications, and highlights of the program to help us obtain funding for all 32 networks! Your 'Major Accomplishments' section is what we'll use for the I&M Program's annual Report to Congress to justify the funding spent by your network.)
√	In the 'Status of Park Vital Signs Monitoring' table, all entries are equal to or greater than the entries in last year's report.
n/a	Photographs that might be included in one of the reports to Congress, brochures, websites, or other materials that help the program have been submitted by the network. (See the guidelines for submitting photographs.)
√	The aarwp file has been renamed using the network's 4-character alpha code and the years (FY0304) as in the example NCCN_FY0304_aarwp.doc
√	The annual report has been approved by the appropriate individuals, per my region's procedures. (If you cannot get electronic signatures, it is okay to submit a hard copy with signatures after November 8.)
√	I have followed my region's procedures for submitting the two files (e.g., NCCN_FY0304_aarwp.doc and NCCN_FY0304_aarwp.mdb). (Most regions require you to submit the files through the regional office. The files may be zipped into a zip file if desired, and then submitted to Steven Fancy via either email or ftp).
	Review of FY 2004 Work Plan by WASO
yes	[Enter Yes or No]: Has the FY 2004 workplan been approved by the network Board of Directors, and therefore ready for the full WASO review? (If you enter No, the WASO I&M and WRD offices will only briefly review the work plan for 'red flags'.

I. OVERVIEW AND OBJECTIVES

The Greater Yellowstone Inventory and Monitoring Network (GRYN) consists of four park units located within and around the Greater Yellowstone Ecosystem, which includes parts of Idaho, Montana and Wyoming. These units include: Bighorn Canyon National Recreation Area (BICA), John D. Rockefeller, Jr. Memorial Parkway (JODR), Grand Teton National Park (GRTE) and Yellowstone National Park (YELL). For the purposes of this report, the John D. Rockefeller, Jr. Memorial Parkway is considered part of Grand Teton National Park.

Inventory activities within the GRYN for fiscal year (FY) 03 included: non-native vascular plant inventory in YELL and GRTE; amphibian inventory at YELL and GRTE; alpine vascular plant inventory at YELL; alpine lakes fish inventory, Snake River and Yellowstone cutthroat trout inventory and sage grouse survey at GRTE; bat inventories at all Network parks; and a mammal inventory at BICA. Non-native vascular plant crews in GRTE identified new invasions of tamarisk and three species of ornamentals during the 2003 survey. They are currently finished inventorying all five weed management zones and will focus on collecting inventories to fill data gaps and eradicating the tamarisk invasion along the Snake River riparian zone during FY 04. Inventory data is being used to create eradication and containment plans for exotic species found. In addition, this was the third year of the exotic plant inventory project at YELL. Researchers at Montana State University (MSU) are testing several survey methods in order to create the most reliable, efficient and consistent detection of low-occurrence populations. They have established a new method, called the “targeted transect method,” which has identified twenty-six of the sixty-two exotic species on the YELL priority list. They have also determined that rights-of-ways are a principal disturbance factor affecting exotic species distribution. The YELL alpine plant inventory, led by YELL botanist Jennifer Whipple, although weakened by the drought conditions (which caused low flowering and fruit set), was successful in collecting 241 species, including two species not previously reported and one species verified as occurring within park boundaries (according to preliminary examination).

Amphibian inventory personnel conducted surveys at 189 wetland sites in YELL and GRTE. Crews were successful in finding boreal chorus frog, tiger salamander, Columbia spotted frog and boreal toad breeding sites during the survey. Past recommendations to GRTE for protecting breeding site areas within the Snake River quarry area were successful in keeping breeding populations present at the sites despite extensive landscape alteration. Occupancy rates of chorus frogs and spotted frogs declined, while tiger salamander occupancy remained stable based on the Proportion of Area Occupied methodology developed by the U.S. Geological Survey (USGS). In addition, eleven alpine lakes were surveyed for fish species in GRTE in 2003. Yellowstone cutthroat trout were found at Grizzly Bear Lake, although no previous record exists of stocking at the lake. An inventory to systematically sample and document the geographic distribution of Snake River and Yellowstone cutthroat trout took place at GRTE and other federal lands in the Upper Snake River watershed. Although funded by numerous sources other than the Network in FY 03, reports and data will be made available to the Network.

GRTE personnel conducted a helicopter survey to identify existing and new sage grouse leks. One new lek was observed, with six male grouse strutting at the site. A Global Positioning System (GPS) location for the lek was recorded and mapped and the lek was observed from the

ground for the remainder of the season. The bat and small mammal inventories were highly successful, given preliminary data. Using mist-net captures, staff of the Wyoming Natural Diversity Database documented most bat fauna predicted to occur within the region and two species previously undocumented in BICA. Bat inventory personnel also completed a Geographic Information System (GIS) habitat model to facilitate the selection of suitable bat inventory sites and initiated the development of a bat call library to facilitate future acoustic monitoring efforts. Personnel also surveyed twelve locations for undocumented mammals and added the white-footed mouse (*Peromyscus leucopus*) to the formally documented list.

In addition to successful inventories throughout the Network parks, the GRYN Vital Signs Monitoring Program has made much progress toward monitoring in the last year. The GRYN created a plan for designing conceptual ecological models that describe the interactions among the key components of terrestrial, aquatic and geothermal systems within the Network. With the help of numerous experts who have vast knowledge of these systems, the conceptual models identified many potential vital signs. Simultaneously, the results from the third and final iteration of the internet-based Delphi survey were received, having been completed in conjunction with the University of Idaho-College of Natural Resources. Meanwhile, the GRYN held park-specific workshops in order to gain insight into the strengths and weaknesses of the potential vital signs, the conceptual modeling process and the selection criteria. These workshops were created to gain park input into the vital signs selection process, as well as acquire peer review on the proposed set of selection criteria questions to be used to select vital signs. The information obtained was essential to the success of the criteria during the Vital Signs Monitoring Workshop, held in Bozeman, Montana in May 2003. At this workshop, almost sixty subject-area experts were invited to share their expertise by ranking all potential vital signs (from both the conceptual modeling and Delphi processes) using the selection criteria. By all accounts, the workshop was a success and allowed for input from experts from other government agencies, academia and the non-profit and private sectors. Using this wealth of information, the GRYN hosted a Technical Committee meeting in which members used the ranked results of the expert workshop, added their management expertise, and created a proposed final list of vital signs for approval by the Board of Directors (BOD). The BOD approved this list in August 2003.

The completion of the Phase II Report was an essential component in the accomplishments of FY 03. Beginning in March 2003, the GRYN hired, on contract, a writer/editor to edit the previous versions of chapters one and two of the Vital Signs Monitoring Plan from the Phase I Report and create chapter three, a synopsis of the vital signs selection process. After a draft version of the report was finished in early September 2003, this version was sent to the Science and Technical Committees for peer review. Peer review occurred in the form of a Science Committee meeting in late September 2003, with many Technical Committee members attending. Peer review comments received during this meeting have been, and will continue to be, very useful for the continuing refinement of the vital signs list. Of note was the suggested addition of one vital sign to the list, along with divisions of vital signs and name changes. Furthermore, the Science Committee applauded the use of conceptual models during the process and recommended the continued use of models to explain the interconnectedness of the vital signs.

The GRYN prepared a separate Phase II Report for the water quality monitoring portion of the program. This Phase II Water Quality Report is scheduled for completion early in FY 04. During FY 03, the core water quality group focused on several topics, including: 1) the development of and solicitation of requests for proposals for projects such as protocol development, synoptic studies, technical assistance requests for study plans, statistical frameworks/designs; 2) summarizing management issues and stressors related to water quality; 3) summarizing current water quality monitoring efforts; 4) a review of available field protocols for National Park Service-Water Resources Division (NPS-WRD) “core parameters”; and 5) the development of monitoring objectives for impaired, or 303(d) listed, waters within Network parks.

Furthermore, the Network has completed hiring its permanent, full-time staff. These hires included the addition of Dr. Robert Bennetts, formerly of the USGS, as the GRYN Ecologist and Robert Daley, formerly of the U.S. Department of Agriculture (USDA) Forest Service, as the Network Data Manager.

The GRYN objectives for FY 03-04 follow; accomplishments towards these goals are reviewed in Section II of this report.

FY 03 Objectives for the GRYN Biological Inventory Program

1. Develop and implement a plan that communicates the mission and accomplishments of the GRYN with professional standards of writing, reporting and data analysis.
2. Develop and implement a data management plan for the Network (including both inventory and monitoring components of the program).
3. Describe the distribution and relative abundance of vertebrate and vascular plant species, targeted species, taxonomic groups and/or species assemblages that are of special concern to GRYN parks.
4. Develop an institutional framework for governing and overseeing the administration of the Biological Inventory Program.

FY 03 Objectives for the GRYN Vital Signs Monitoring Program

5. Maintain an administrative and organizational framework for the GRYN Vital Signs and Water Quality Programs.
6. Identify and prioritize all terrestrial and aquatic indicators; then, develop protocols and implement programs to monitor vital signs.
7. Summarize and analyze existing information and concepts important for assessing current and future monitoring efforts and needs in the Network parks.

FY 03 Objectives for the GRYN Water Quality Monitoring Program

8. Summarize and analyze existing information and concepts important for assessing current and future water quality monitoring efforts and needs in the Network parks.
9. Implement and maintain an integrated GIS and data management program for water quality data.
10. Identify and prioritize all water quality indicators; develop/review/evaluate protocols and implement programs to monitor the vital signs.

11. Develop and maintain a strategy to share information with Network parks, scientists and others interested in the Network Inventory and Monitoring (I&M) Program.

FY 04 Objectives and scheduled activities for the GRYN Biological Inventory Program

1. Create and maintain information-sharing strategies in an effort to integrate the I&M and Water Quality Programs into park activities and facilitate and manage the use of collected information.
2. Develop, implement and maintain an integrated plan for data management in the Network (including inventory, monitoring and water quality components of the program).
3. Describe the distribution and relative abundance of vertebrate and vascular plant species, targeted species, taxonomic groups and/or species assemblages that are of special concern to GRYN parks.
4. Maintain an administrative and organizational framework for the GRYN Inventory, Vital Signs and Water Quality Monitoring Programs.

FY 04 Objectives and scheduled activities for the GRYN Vital Signs Monitoring Program

5. Identify specific monitoring objectives associated with each vital sign, starting with those listed as high priorities.
6. Develop sampling designs for those monitoring objectives approved by the Board of Directors.
7. Develop protocols in accordance with the guidelines of the National Park Service (NPS) I&M Program.
8. Develop a strategy for leveraging funds from outside sources to enhance the monitoring capabilities of the Network.

FY 04 Objectives and scheduled activities for the GRYN Water Quality Monitoring Program

9. Summarize and analyze existing information and concepts important for assessing current and future water quality monitoring efforts and needs in the Network parks.
10. Implement and maintain an integrated GIS and data management program for water quality data.
11. Develop protocols for regulatory 303(d) monitoring; have protocols peer reviewed; implement peer reviewed monitoring protocols.

II. ACCOMPLISHMENTS AND SCHEDULED ACTIVITIES

FY03 ACCOMPLISHMENTS FOR INVENTORY PROGRAM

- 1 **Develop and implement a plan that communicates the mission and accomplishments of the GRYN program with professional standards of writing, reporting and data analysis.**
 - 1.1 *Prepare a communications plan for the Network, including a Network logo, letterhead and memorandum style.*

FY 03 Accomplishments: While a formal communications plan for the GRYN has not yet been finalized due to the FY 03 focus on vital signs workshops and planning, the Network, in conjunction with the Communications Director, has made great strides toward establishing a formal and consistent manner of communicating activities and results. A Network logo was

created in early 2003 and used throughout the workshop series. Furthermore, a memorandum style has been selected by which to communicate the results of meetings and conference calls in an efficient and professional manner.

1.2 Prepare and publish reports and ensure delivery to each Network park, the I&M program manager, the Intermountain Region I&M Coordinator and entry into NatureBib, if relevant.

FY 03 Accomplishments: The Network spent much time and effort this fiscal year to ensure that promised draft and final reports were distributed in a professional manner to relevant reviewers and committee members. For example, Network staff delivered draft review copies of the Vital Signs Monitoring Report to all committee members electronically, as well as final printed copies sent by mail. In addition, staff made available electronic and hard copies of the “Technical Notes” (describing, in detail, the scope of the vital signs) and the “Protocol Template” (in-depth instructions to contributors about what is required for a Network protocol) to committee members for review. Furthermore, Network staff provided Technical Committee and BOD members with information from the climate and air quality/atmospheric deposition compilation and analyses (described in task 8.2). Approximately three weeks before the due date for the Phase II Report, staff provided, by mail, copies of the report to Science and Technical Committee members and the BOD for review. Final copies of this report were also sent by mail to these members.

1.3 Design and launch a website about the GRYN that contains copies of study products, reports and publications.

FY 03 Accomplishments: In Spring 2003 the GRYN launched a new website containing background information about the GRYN, park maps, inventory and monitoring reports and presentations, information on the Delphi survey and conceptual modeling process, along with contact information for Network staff and committees. This website was updated after critical checkpoints in the program passed (i.e., the Phase II Report was finished). The website address is:

<http://science.nature.nps.gov/im/units/gryn/monitoring.shtml>

1.4 Remain updated as to successful methods of providing gathered information (i.e., through other networks, parks or agencies).

FY 03 Accomplishments: An important program of note is the USGS National Biological Information Infrastructure (NBII) Information Node, currently being established, whose goal is to “develop an information resource that will be useful to Federal, state, and local agencies, universities, non-governmental entities, and the general public in addressing issues concerning management of public lands. In addition to increasing the utility of both historical and newly collected data, we will provide decision support tools and systems to address specific management and science needs of our partners and clients.” The Northern Rockies Information Node is located on the campus of Montana State University. The Network has plans to use NBII as a web portal for the transfer of information to interested parties.

2 Develop and implement a data management plan for the Network (including both inventory and monitoring components of the program).

2.1 *Prepare a draft data management plan that includes strategies for Network-wide data sharing and archiving.*

FY03 Accomplishments: Because the Network's Data Manager began work at the end of FY 03 (see task 5.1 for explanation), the data management plan has not yet been completed. However, preparations have begun toward the development of a successful plan for management of existing and new information. Furthermore, the Data Manager will serve as the point-of-contact for NPSpecies certification, as approved by all park units. Completion of the data management plan is of highest priority for the first quarter of FY04.

2.2 *Assemble a data management work group to inventory and compile existing GIS themes, identify data gaps, secure high-priority spatial data and advise on Network database projects.*

FY 03 Accomplishments: Because the GRYN Data Manager was not hired until the end of FY 03 (see task 5.1), data management support activities were lead by Ann Rodman, supervisory GIS specialist at Yellowstone Center for Resources (YCR). Ann and staff provided support to the Network via telephone and in-person meetings on GIS, remote sensing, database design and other data management issues described under objective 2 and in sections 3.3 and 9.1.

Existing GRYN data layers were inventoried, data gaps identified, and potential sources of new data were discussed with GIS staff at the three Network parks. Ann coordinated a request to the regional office for updated National Hydrography Dataset (NHD) data for the Network. This included watershed areas north of YELL and surrounding BICA. The Network also acquired ArcGIS-ArcInfo software through an NPS enterprise agreement.

An inventory of Remotely Sensed Imagery (aerial photographs and satellite imagery) to determine what datasets are currently owned and available was completed for the Network. The results of the inventory were documented in Dataset Catalog. For Yellowstone alone there are twenty-five park-wide sets of aerial photographs spanning 1959-1998. There are currently thirty LANDSAT scenes covering various parts of the GRYN from 1985 to 2003. Earlier this year the Network purchased two scenes from August and September of 1999. This gives the Network five nearly cloud-free scenes; all acquired at the same time of year. Ann's staff mosaiced the five images into a giant composite image of the GRYN area.

Digital Ortho Quarter Quads (DOQQ) and Digital Raster Graphics (DRG) imagery were compiled for the areas including and surrounding YELL and GRTE. All imagery was clipped, re-projected and tied to index grids to form a complete coverage for this region. In addition, indices have been created that allow a GIS user to easily select the necessary DOQQ or DRG by clicking on the area of interest.

Data gathering to locate all potential geologic resource extractions (mining and exploration) within twenty miles of a Network park was completed under Ann's supervision. The project consists of GIS layers linked to data tables. The locations are tied to a grid of Township and Range sections that Ann and staff created around each

park. The leasing data comes primarily from the Bureau of Land Management (BLM) LR2000 database. The database can now be kept current by asking the BLM for periodic data dumps. The database includes more than 10,000 records, including over 8,000 mining claims and 234 oil and gas leases near the park boundaries. Most of the activity is concentrated north of Yellowstone and south of Bighorn Canyon. For example, just south of Bighorn Canyon, within twenty miles of the park, there are 277 placer claims, 123, clay/bentonite claims, twelve oil and gas leases, nineteen load claims, and three mill site claims. This information will be used in conjunction with watershed boundaries to monitor the potential for negative impacts to park resources.

2.3 Complete a review and certification of the NPSpecies Database (according to Service-wide standards) for accuracy and completeness. Coordinate with Technical Committee on Network definition of 'species of special concern' and code NPSpecies accordingly.

FY 03 Accomplishments: A Memorandum of Agreement (MOA) between the GRYN and the superintendents of YELL, BICA and GRTE to designate the Network data manager as point-of-contact for the NPSpecies database was approved at the BOD meeting on August 8, 2003. The MOA, considered a benefit to the parks, will remain in effect for the duration of the GRYN, but can be amended in the future. In preparation for certification, all of the information for YELL's vertebrates was reviewed by park staff for completeness and accuracy. Omissions and errors were corrected in NPSpecies so that the certification process can move forward in the first quarter of FY04. For vertebrates, NPSpecies will now be used as the official species list for the park and will be used as the link to electronic field guide information on the NPS website. Suzanne Morstad, BICA ecologist, worked with local bird experts from the BLM and the Audubon Society to update the bird list, abundance information and references in NPSpecies for BICA.

2.4 Develop an action plan for quality control and updating NatureBib.

FY 03 Accomplishments: The GRYN hired Sarah Stehn through a task agreement with MSU-Big Sky Institute to add and update NatureBib records and acquire hard copies of papers for the Network literature review. This effort, although affecting a small percentage of the total entries for Network parks, provided insight into some of the data entry and quality issues in the database, such as the need to develop a topic/keyword system. Over 175 papers were obtained and organized and their respective NatureBib entries created or corrected using the most recent guidance for data entry. Sarah added over fifty new abstracts and entered twelve annotations, corrected citations and removed duplicate entries.

2.5 Develop Standard Operating Procedures for efficient data capture. Assign data management staff to visit each Network park to gather and input new records into NatureBib, NPSpecies and Dataset Catalog as appropriate.

FY 03 Accomplishments: The GRYN worked with the Wendy Schumacher (I&M Bibliographic Coordinator) and Carol Simpson (Denver Service Center Librarian) to coordinate the second year of a NatureBib cataloging effort with Emporia State University (Emporia, Kansas) at GRTE. Students from the Emporia State School of

Library and Information Management entered records for publications housed in the Office of Science and Resource Management over four days in May 2003, guided by Network staff on the use of the web interface. Over 300 records were added or updated.

3 Describe the distribution and relative abundance of vertebrate and vascular plant species, targeted species, taxonomic groups and/or species assemblages that are of special concern to GRYN parks.

3.1 *Implement inventory projects identified and scheduled in the Vertebrate and Vascular Plant Inventory Study Plan.*

FY 03 Accomplishments: Inventory activities within the GRYN for FY 03 included: non-native vascular plant inventories in YELL and GRTE; amphibian inventory at YELL and GRTE; alpine vascular plant inventory at YELL; alpine lakes fish inventory, Snake River and Yellowstone cutthroat trout inventory and sage grouse survey at GRTE; bat inventories at all Network parks; and a mammal inventory at BICA.

Exotic vascular plant surveys at GRTE were performed under the volunteered guidance of Steve Haynes, GRTE vegetation management specialist. The FY 03 survey focused on rights-of-way, with crews walking 460 miles of road shoulders, twenty-nine miles of utility corridors, twenty-eight miles of the Jackson Lake shoreline and fifteen miles of horse trails. A total of thirty-six exotic weed species were found with 4600 locations mapped. Crews identified new invasions of tamarisk and three species of ornamentals during the 2003 survey. They are currently finished inventorying all five weed management zones and will focus on collecting inventories to fill data gaps during FY 04. Inventory data are being used to create eradication and containment plans for exotic species found. A poster on using GIS and GPS to develop realistic management strategies for non-native plant invasions will be presented by Steve Haynes at the Ecological Society of America/Weed Science Society of America (ESA/WSSA) Meeting in Fort Lauderdale, FL in November 2003.

This was the third year of the exotic plant inventory project at YELL. Researchers at MSU are testing several survey methods in order to create the most reliable, efficient and consistent detection of low-occurrence populations. They have established a new method, called the “targeted transect method,” which has identified twenty-six of the sixty-two exotic species on the YELL priority list. They have also determined that rights-of-way are a principal disturbance factor affecting exotic species distribution. This year researchers improved data analysis tools, allowing for standardization and re-evaluation of previous years’ data and creating an opportunity for integration of previously collected data into a comprehensive database. These techniques are of interest to the Forest Service and other universities and, therefore, training sessions have been created for the Gallatin National Forest. This work will be presented at a number of meetings and symposia (Invasive Exotic Plant Detection Workshop, Invasive Plants in Natural and Managed Systems Meeting, Yellowstone Biennial Science Conference) and will be developed as manuscripts for a special issue of *Biological Invasions* by Bruce Maxwell and Lisa Rew (MSU).

The YELL alpine vascular plant inventory resulted in the collection of 241 plant species, in spite of drought conditions. The investigators found two previously unrecorded plant species (according to preliminary examination). This work was led by YELL botanist Jennifer Whipple, who volunteered her time, and enlisted the help of a three to six person field crew, along with donated time of an MSU graduate student. All specimens will be identified and verified at Montana State University this winter and fieldwork will continue in 2004 at targeted areas identified in 2003 and the southern end of the Gallatin Range.

Amphibian surveys were conducted by Deb Patla and Chuck Peterson of Idaho State University. Amphibian inventory personnel conducted surveys at 189 wetland sites in YELL and GRTE. Crews were successful in finding boreal chorus frog, tiger salamander, Columbia spotted frog and boreal toad breeding sites during the survey. Past recommendations to GRTE for protecting breeding site areas within the Snake River quarry area were successful in keeping breeding populations present at the sites despite extensive landscape alteration. Occupancy rates of chorus frogs and spotted frogs declined, while tiger salamander occupancy remained stable based on the Proportion of Area Occupied methodology developed by the USGS. New techniques were also tested. One technique involved mapping of predicted wetland areas that were not listed in the National Wetland Inventory; six breeding sites were found in these areas. Furthermore, the group tested the probability of detecting certain species on single visits and concluded that they had a high probability of detecting boreal chorus frogs and Columbia spotted frogs, but low probability of detecting tiger salamanders. The results will help in future sampling designs and schedules. The investigators collaborated with GIS staff at YELL to prioritize herpetological sites for project planning and management decisions in the park and conducted field surveys for the Aquatic Resources Division of YCR to aid in the management of west slope cutthroat trout. Both lead investigators attended the Vital Signs Monitoring Workshop, created conceptual models and created a technical note on the importance of amphibian occurrence as a vital sign. Furthermore, their results will be presented at the Society of Environmental Toxicology and Chemistry Annual Meeting in November 2003 and a year-end workshop with USGS-Amphibian Research and Monitoring Initiative (ARMI). The researchers are also collaborating with USGS-Earth Resources Observations Systems (EROS) to construct geospatial models for amphibian breeding habitat and with another USGS project to determine the occurrence of chytrid disease in the Greater Yellowstone Ecosystem (GYE). The investigators also conducted research under the U.S. Fish and Wildlife Service (USFWS) at the National Elk Refuge adjacent to GRTE.

Eleven alpine lakes were surveyed by Wyoming Game and Fish for fish species in GRTE in 2003. Yellowstone cutthroat trout were found at Grizzly Bear Lake, although no previous record exists of stocking at the lake. The investigators will be researching the reason for the existence of this species at the lake. Nets were not set in Rimrock Lake due to safety concerns on reaching the lake and returning to camp in one day. Two of the lakes scheduled for sampling this year, Talus Lake and Dudley Lake, were not surveyed. It is unclear at this time if it is possible to reach Dudley Lake (without climbing gear) as attempts were unsuccessful this year. A different route to Talus Lake has been

determined and sampling will be complete in 2004. Sampling was conducted according to project proposal. Basic water chemistry information, plankton samples, net locations and digital photos were collected from all lakes. This information will be included in the 2003 final report that will be completed in February 2004.

An inventory to systematically sample and document the geographic distribution of Snake River and Yellowstone cutthroat trout took place at GRTE and other federal lands in the Upper Snake River watershed. This work was completed by the USDA Forest Service and funded from a combination of sources, including: Jackson Hole One-Fly; Jackson Hole Trout Unlimited; Embrace-a-Stream; GRTE; Greater Yellowstone Coordinating Committee; Wyoming Game and Fish Department; Bridger-Teton National Forest; and the Forest Service Intermountain Region. Reports and data will be made available to the Network. In FY 04 the Network will fund a continuation of this survey, from Jackson Lake north to the headwaters in YELL.

Sue Wolff, GRTE wildlife biologist, led a helicopter survey to identify existing and new sage grouse leks. One new lek was observed, with six male grouse strutting at the site. A GPS location for the lek was recorded and mapped and the lek was observed from the ground for the remainder of the season. This lek will continue to be monitored annually, and data will be integrated into the I&M Program.

The bat and small mammal inventories were highly successful, given preliminary data. Using mist-net captures, staff of the Wyoming Natural Diversity Database documented most bat fauna predicted to occur within the region and two species previously undocumented in BICA in 150 sites throughout the parks. Overall, the study documented eleven bat species at BICA, six at GRTE and five at YELL. Bat inventory personnel also completed a GIS-based habitat model to facilitate the selection of suitable bat inventory sites and initiated the development of a bat call library to facilitate future acoustic monitoring efforts. Numerous potential bat roosts and hibernacula were also identified for future investigation. Investigators aided the Teton Science School in developing a student-run bat project and mist-net demonstration. Personnel also surveyed twelve locations for undocumented mammals and added the white-footed mouse (*Peromyscus leucopus*) to the formally documented list.

To help off-set a shortage of park housing for cooperators, the Network leased a mobile trailer and stationed it in Gardiner from June-August and rented a trailer space from the concessionaire at Lake. The Network funded a non-native vascular plant inventory in YELL and bat inventories throughout the GRYN for FY 04 using FY 03 monitoring funds (please note Table 1).

Table 1. Vascular Plant and Vertebrate Inventory Projects scheduled between FY 2002-2004 showing the budget year the project was pre-funded using Vital Signs Monitoring funds.

Project name	2002			2003			2004		
	BICA	GRTE	YELL	BICA	GRTE	YELL	BICA	GRTE	YELL
Non-Native Vascular Plant Inventory	✓	✓	✓		✓	✓		✓	✓ FY03
Yellowstone Cutthroat Trout – Upper Snake								✓	✓
Amphibian Inventory	✓	✓	✓		✓	✓			
Sage Grouse Survey					✓				
Alpine Vascular Plant Inventory						✓			✓
Alpine Lakes Fish Inventory					✓				
Bat Inventory				✓	✓	✓	✓ FY03	✓ FY03	✓ FY03
Mammal Inventory				✓					
	GRTE	Includes John D. Rockefeller Jr. Memorial Parkway							
	FY03	Fiscal Year (FY) indicates the year the project was prefunded using the Vital Signs Monitoring account.							

3.2 Sponsor an exotic plant species workshop to share information about current exotic species inventories in the Network.

FY 03 Accomplishments: An Exotic Weed Workshop, sponsored by the GRYN, was held January 29-30, 2003 in Bozeman, Montana. The weed workshop represented a gathering of professionals from NPS, academia and other government agencies who shared information on current and future weed monitoring activities, predictive modeling and other weed resources. This workshop was an effective method for enhancing the communication, cooperation and coordination among these groups.

3.3 Prepare a report of herbarium specimens from Network parks found at the University of South Dakota.

FY 03 Accomplishments: The Network gave funds to Katie Solberg, an NPS technician, to catalog herbarium specimens at the University of South Dakota from the parks of the Network. She has had great success in finding species in all three parks, including significant amounts of specimens collected in 1938 and 1954 in YELL. She is currently taking digital photographs of all specimens and will prepare a report based on her findings that will be completed this fall.

3.4 *Conduct standard analyses of data and present the results of such analyses as background material in Vital Signs Monitoring Plan and make available for vital signs planning workshops.*

FY 03 Accomplishments: To prepare for the ranking and selection of vital signs, the GRYN developed selection criteria, a set of thirteen questions used to determine the effectiveness of a potential vital sign for monitoring the long-term ecological health of the parks. Moreover, the Network compiled information specific to the vital signs that would aid workshop participants in the ranking process. This information included descriptions of the vital signs (i.e., why is this potential vital sign important to monitor), as well as the source of the vital sign (i.e., Delphi or conceptual models) and any legislation affecting the monitoring of the potential vital sign.

The information was put into a Decision Support System Access database that also contained the scoring information provided by the participants and used to rank the potential vital signs. Ann Rodman and staff at the Spatial Analysis Center customized and populated the Decision Support System database used by the Network to sort and prioritize hundreds of potential vital signs. The work involved building the database (tables, relationships, queries and forms), adding hard-coded functionality to the forms and building all the reports needed to summarize results. The database allowed the Network to quickly compare, in an unbiased manner, all of the input from workshop attendees.

Furthermore, after the completion of the Vital Signs Monitoring Workshop, Network staff began developing a set of “Technical Notes” that built upon the information contained within the database to inform the Technical Committee, Science Committee and Board of Directors of the importance of the vital sign, current and past monitoring, relative cost of monitoring and any costs that could be subsidized through collaborations with other agencies. These notes proved helpful in defining the scope of the vital signs and eliminating some confusion over the meaning of the vital sign name.

4 **Develop an institutional framework for governing and overseeing the administration of the Biological Inventory Program**

4.1 *Assure adherence to established NPS Service-wide and generally accepted scientific standards, including quality assurance and quality control on inventory data and reports.*

FY 03 Accomplishments: In order to assure adherence to Service-wide and scientific standards, the GRYN created a metadata interview for collaborators and cooperators that follows the Federal Geographic Data Committee (FGDC) standards. Also, a Resource Management Project Plan outline was acquired from the USGS to help guide the collection of metadata. In addition, all references in Network reports were converted to or created with the newest Council of Biological Editors (CBE) style.

4.2 *Assure adherence to established Service-wide fiscal, NEPA and other compliance, data management and reporting standards.*

FY 03 Accomplishments: A budget accounting database was obtained from the Great Lakes Network and adopted by the GRYN to track budget expenditures. Queries were developed to append records to the Annual Administrative Report and Work Plan

(AARWP) budget database. In addition, online training, certification and applications were completed for travel. A purchase credit card was obtained by the Program Manager and an SOP put into place for purchase records and monthly reviews. Furthermore, a summary table was prepared and distributed to Network staff to help communicate the December 18, 2002 guidance for use of monitoring funds to support existing monitoring or to conduct pilot studies. The table is an efficient way to evaluate the role of peer review and approval of study designs before implementation of monitoring on the ground. Administrative support, including budget tracking and procurement, was obtained through YELL, GRTE and the Intermountain Support Office. At BICA, a Network staff member created the first-ever NPS electronic research permitting system and served as the park research coordinator to process permits. The database on non-native vascular plants was reviewed for compliance with North American Weed Management Association (NAWMA) mapping standards. Changes and corrections were noted and communicated to the cooperator.

4.3 Establish a Network contact for each study who, acting as an Inventory Coordinator, will assist in the management of the project.

FY 03 Accomplishments: A project-tracking spreadsheet was prepared to keep track of projects, cooperators, project start and end dates, deliverables and Network contacts. This spreadsheet was used to log important correspondence and activities. The Rocky Mountains Cooperative Ecosystem Studies Unit (RM CESU) was notified of Network contact changes.

4.4 Establish templates for products, such as progress and final reports, and ensure deliverables follow the template.

FY 03 Accomplishments: Throughout its efforts to maintain an efficient and professional manner of communicating progress and results, the GRYN has developed a template for notes and interim reports, as well as final reports. Furthermore, Network staff have developed a protocol template in order to ensure that the proper information is retrieved from cooperators. This template will be used to guarantee the completeness of deliverables.

4.5 Establish data storage, archival headquarters and/or an institutional library for the Network. Establish permanent institutional repositories for voucher specimens collected.

FY 03 Accomplishments: A computer server was installed in the Bozeman office and NPS computers networked together. A computer backup system, which includes a snap server, tape and DVD drives, were purchased and installed and regular back-up procedures implemented. Steve Miller from YELL helped the Network with its computer administration while there was no Data Manager in place. Arrangements were made with Dave Dyer, curator of the Phillip L. Wright Vertebrate Museum at the University of Montana-Missoula, to accept bat voucher specimens from GRTE and BICA and small mammal vouchers from BICA.

4.6 Update the Network charter and allow for thirty days review by Board of Directors and Technical Committee. Deliver a fully executed copy to the Service-wide and Regional I&M Program Managers.

FY 03 Accomplishments: The Network charter was updated in early July 2003 in order to identify changes in the expectations of committee and BOD members during FY 04. While most changes were minor, important changes of note include: clarification of the responsibility of the BOD in accountability; clarification of the role of the Science Committee (SC) in peer reviewing monitoring plans and protocols; and clarification on the information included in the annual work plan, including budgetary and implementation information. After discussion among the BOD members, a change to the SC role in the charter was made so that the work plan will be reviewed by the Technical Committee (TC) and approved by the BOD before being sent to the Washington office. This eliminates review by the SC of the work plan. In addition, clarifications were made on the length of the BOD and TC Chairman appointments—two years for the BOD Chair and one year for the TC Chair, with the BOD Chair rotation as BICA, then YELL, then GRTE. For FY 04, Darrell Cook, Superintendent of BICA, will be Chair of the BOD, while Tom Olliff, Chief of Resources at YELL, will be Chair of the TC. The Charter was signed by BOD members and delivered electronically to the Intermountain Regional Office.

FY03 ACCOMPLISHMENTS FOR VITAL SIGNS MONITORING PROGRAM

5 Maintain an administrative and organizational framework for the GRYN Vital Signs and Water Quality Monitoring Programs.

5.1 Increase staffing to handle major programs of work. Recruit for Data Manager, Quantitative Ecologist and a professional Writer/Editor to assist with the production of Phase II of the Vital Signs Monitoring Plan. A graphic artist will be commissioned to develop figures for conceptual model chapter and PowerPoint presentations.

FY 03 Accomplishments: While initial recruitment for the Data Manager position was not as timely as initially planned, a very qualified individual, Robert Daley (formerly of the USDA Forest Service in Idaho), was hired and began work on September 22, 2003. The search and placement of a Quantitative Ecologist proved to be smoother, with Dr. Robert Bennetts (formerly of the USGS in Florida) starting August 25, 2003. Furthermore, the Network hired, on contract, Scott Bischke of Bozeman, Montana as a Writer/Editor for the Phase II Report and temporary web designer. Scott was responsible for the majority of the editing of chapters one and two from the Phase I Report and the original writing found in chapter three of the Phase II Report. In addition, he created the current design of the GRYN website. In place of hiring a graphic artist to design figures and presentations, the Communications Director, Anne Schrag, filled this role during FY 03. Anne recreated most of the conceptual models used throughout the report and appendices using Microsoft Visio software and assisted the Program Manager in creating PowerPoint presentations and posters for National I&M and Network-specific workshops.

5.2 Hire a Communications Director for the Network, using funds in an existing task agreement with Big Sky Institute at MSU, who is responsible for workshop planning,

logistics implementation, preparing reports on workshop results, soliciting for cost estimates, arranging for workshop facilities, preparing invitation lists and making travel arrangements.

FY 03 Accomplishments: Anne Schrag was hired as a part-time temporary employee through Big Sky Institute and began work on January 7, 2003. Since joining the Network, Anne has directed the logistics, planning and reporting for seven professional workshops. Anne has created and implemented a standardized method for communicating the results of Network activities (including a Network logo and reporting format). In addition, she was responsible for soliciting proposals from professional facilitators for a three-workshop contract. The main objective of the job of Communications Director—to prepare and conduct professional workshops—was met with great success throughout the FY 03 workshop series. Moreover, beyond the original scope of duties, Anne has been involved in creating PowerPoint presentations and posters for workshops and the Program Manager and has been deeply involved in the creation of the Phase II Report, including significant editing duties and the compilation of the appendices (which included much of her original work). Anne has been working in a full-time capacity for the Network since May and will continue to do so under a new title within the first quarter of FY 04.

5.3 Detail Glenn Plumb into the network for ninety days to lead the completion of Chapter III of the Vital Signs Monitoring Plan and assist in the development of a Decision Support System to select and prioritize indicators for monitoring presented in Chapter IV. This activity is further described in tasks 6.1 thru 6.8.

FY 03 Accomplishments: Glenn Plumb, Supervisory Wildlife Biologist at YELL, was detailed to the Network originally for ninety days in order to assist the Program Manager in developing a method for creating conceptual ecological models to help determine proposed candidate vital signs. During this time, Glenn identified other experts to create conceptual models with which the Network created cooperative agreements. He wrote an exciting paper about the utility of conceptual models in the NPS and beyond. In addition, Glenn was primary author of the Network's selection criteria used to select vital signs and the weighting used to score the selection criteria worksheets during the Vital Signs Monitoring Workshop. He also helped to develop the Access Decision Support System database used to store information about the vital signs and scoring. Furthermore, Glenn attended both park-specific workshops and the Vital Signs Monitoring Workshop and provided helpful critique during preparation and writing of chapter two of the Phase II Report. In order to accomplish these tasks, the original detail period was extended to 120 days with approval.

5.4 Complete MOUs between the Network and BICA and GRTE (where Network employees are duty stationed) to ensure that funds supporting these positions comply with administrative guidance for I&M funds and to establish standard operating procedures for employee time, travel and purchasing.

FY03 Accomplishments: No official Memorandum of Understanding (MOU) was created between the Network and the parks relating to Network employees. Rather, the ecologist position at BICA, held by Laura Gianakos, was moved to Network-employee status. Therefore, the Program Manager established a standard operating procedure

(SOP) on supervision, property and disciplinary action with Rick Lasko, BICA Chief of Resources. Laura's position code, supervisory chain and hierarchy on her Bank of America purchase card were also changed. Along with Rick, Cathie Jean and Laura discussed a communications strategy for reporting to Network and BICA staff, with Cathie taking over time card signing, purchase card review and travel authorization approval.

5.5 Move office facilities from Mammoth, WY to Bozeman, MT, inventory and consolidate computer files and then duplicate database, GIS and user directories to Network server in Bozeman. Transfer property records to Intermountain Support Office (ISO). Prepare an interagency agreement with Northern Rocky Mountain Science Center (USGS) to pay for facilities at the Forestry Sciences Lab at Montana State University.

FY 03 Accomplishments: Office facilities were successfully moved from the Yellowstone Center for Resources in Mammoth, WY to the Forestry Sciences Lab in Bozeman, MT. Furniture was purchased for the office to accommodate the incoming Data Manager and student help. All previous I&M data, along with a copy of Yellowstone's GIS data, were moved to a server dedicated to the Network in Bozeman. A draft computer security plan was completed. With the assistance of Steve Miller from Yellowstone, the Network upgraded its primary operating system and software to Windows/Office XP. Lori Wilkinson of Yellowstone also assisted with Lotus Notes support. A regular backup schedule for the server was implemented. All property was inventoried and records were transferred from Yellowstone to Chris Theriault at the Intermountain Support Office. An interagency agreement was completed with USGS to pay for GRYN facilities.

6 Identify and prioritize all terrestrial and aquatic indicators; then develop protocols and implement programs to monitor vital signs.

6.1 Continue conceptual model development with the objective to integrate the models with a narrative literature review that will serve to guide the selection of candidate indicators and permit filtering, rank-ordering and prioritization of selected vital signs.

FY 03 Accomplishments: All of the eleven terrestrial, two aquatic and one geothermal system models have been completed. After final assignments were made, Duncan Patten (MSU) was responsible for the development of four terrestrial system models (one co-created with Dan), Dan Tinker (University of Wyoming) created five terrestrial system models (one co-created with Duncan), Bob Hall (University of Wyoming) made two aquatic system models, Glenn Plumb (YELL) created two terrestrial system models, Hank Heasler and Cheryl Jaworowski (YELL) created the geothermal model and Cathie Jean created one terrestrial model. Each conceptual model author constructed schematic and narrative models for each system; these models are included in the Phase II Report Appendices. The purpose of the schematic models is to show the interconnectedness of the vital signs within a system, while the narrative models explain these linkages. Attendance at the vital signs workshops was as follows: all conceptual model authors (except Cheryl Jaworowski) attended the Vital Signs Monitoring Workshop; Duncan Patten, Glenn Plumb and Cathie Jean also attended both park-specific workshops; and Hank Heasler also attended one park-specific workshop. Duncan Patten was an essential

part of the core planning team throughout the vital signs selection and peer review processes.

In support of the terrestrial conceptual model development, staff at YCR prepared vegetation maps, cross-walking to a common vegetation classification for each of the three Network parks. In addition, data tables provided summary statistics that aggregated vegetation types by watershed level. The results were used by the conceptual model authors in the planning phase of conceptual model development. Furthermore, in order to recreate these models for inclusion in the Vital Signs Monitoring Workshop and Phase II Reports, the GRYN purchased Microsoft Visio software. This software allowed the Network to create professional-grade recreations of the schematic models. In addition, the conceptual models served as an “ice breaker” at the Vital Signs Monitoring Workshop, wherein participants were invited to an after-hours social to discuss and peer review the models, which were enlarged to 3’x4’ poster size. While none of the authors (other than Program Manager Cathie Jean) was an author on the second version of the conceptual models chapter in the Phase II Report, their previous input, writing and peer review throughout the writing process proved invaluable.

6.2 Complete literature review. Continue to prepare annotated bibliography for selected references to be used in the Vital Signs Monitoring Plan.

FY 03 Accomplishments: A literature review consisting of about 350 entries was completed this year. This review contained articles in the following broad topic areas: air, biodiversity, biological inventories, birds, carnivores, climate, ecosystems, exotics, fire, fish, forests, geology, herpetofauna, humans, insects, landscapes, mammals, riparian systems, soils, threatened and endangered species, thermal areas, ungulates, vegetation, water and wildlife. Many annotated bibliographies were prepared by a student assistant through the Big Sky Institute. Network staff will continue to prepare annotated bibliographies for the remaining records. This review was made available to conceptual model authors for use in their narrative models and was included in the Phase II Report Appendices in its entirety.

6.3 Assemble lists of ecological indicators and ask participants in Delphi III to rank order indicators and arrive at a selection of proposed candidate vital signs. Allow participants to add indicators to the list (for future reference).

FY 03 Accomplishments: During the third and final iteration of the online Delphi survey, conducted by faculty in the University of Idaho-College of Natural Resources, participants were asked to rank sets of indicators, grouped under broad topic areas, on a scale of 1 to 5. The proposed candidate vital signs were derived from rounds one and two of the survey, wherein participants were asked to nominate potential vital signs for monitoring. Over 400 experts were invited to participate in the third round of the survey, with over 100 responding. The faculty proctoring the survey then averaged the given scores and reported the results to the GRYN in late March 2003. In addition, participants were given the opportunity to add potential vital signs they believed to be important but were not present in the survey. The results of this survey were cross-walked with the proposed candidate vital signs from the conceptual modeling process to produce the master list of vital signs for ranking during the Vital Signs Monitoring Workshop.

6.4 Conduct park-specific workshops to review, discuss and add to indicators in Delphi III. Discuss legal and regulatory monitoring requirements, management objectives and current monitoring efforts and how these can be integrated with the Vital Signs Monitoring Program.

FY 03 Accomplishments: Park-specific workshops were conducted at Yellowstone National Park and Grand Teton National Park in March 2003. The purpose of these workshops was to gain park manager insight into: the Vital Signs Monitoring Program; the vital signs selection process; the selection criteria and scoring process; the results of Delphi III; and threats and issues facing the parks. At GRTE, the focus of the workshop was to introduce park staff to the Vital Signs Monitoring Program and gain peer review of the proposed selection process (i.e., selection criteria and proposed ranking) and conceptual models. Moreover, the GRYN hoped to gain insight into threats and issues facing the park. From this meeting, the GRYN gained helpful critique of the selection process, including information that was used to adjust the selection criteria to be scored as yes/no questions instead of giving participants a scale of possible answers. During the YELL workshop, participants peer reviewed the list of proposed candidate vital signs received through the Delphi III survey (this list was not available at the GRTE meeting), as well as gave input on the selection criteria and the conceptual modeling process. Peer review comments received during these workshops were extremely helpful in creating a successful Vital Signs Monitoring Workshop.

6.5 Prepare a monitoring 'strawman' proposal comprised of prioritized candidate indicators selected to date. Present and refine proposal with Technical Committee prior to Vital Signs Monitoring Workshop.

FY 03 Accomplishments: Instead of prioritizing the proposed candidate vital signs before the subject-area expert workshop, the GRYN core planning team decided that using the expertise of the invited guests during the workshop would provide helpful input for the Technical Committee during the final selection process. Therefore, the core planning team created and tested (during park-specific workshops, see 6.4 above) a set of thirteen yes/no questions that served as selection criteria for ranking proposed candidate vital signs. These selection criteria were first proposed by Glenn Plumb after extensive literature review concerning the characteristics of a "good" indicator. The criteria were then adjusted following their trial use during the park-specific workshops. The Technical Committee then approved the selection criteria for use during the Vital Signs Monitoring Workshop as an efficient and effective way of communicating the strengths and weaknesses of the proposed candidate vital signs.

6.6 Hold Vital Signs Monitoring Workshop to present and review strawman Vital Signs Monitoring proposal to a broad audience of internal and external scientists and managers. Break into subject-area workgroups to draft monitoring objectives as a workshop product. Prepare workshop report.

FY 03 Accomplishments: As described in Task 6.5, instead of presenting the vital signs monitoring proposal to a broad audience during this workshop, the GRYN chose to allow the workshop participants to provide input into which indicators should be selected through the use of the selection criteria. This workshop proved to be an effective way of

getting information from a group of subject-area experts. Furthermore, the workshop provided an avenue to garner support from the invited participants for the I&M Program and the Network. The participants also created spatial-temporal models for the highly ranked vital signs, an exercise that provided information to the Network that can be used during Phase III monitoring design. A workshop report, including extensive appendices that contain the conceptual and spatial-temporal models, was prepared shortly after the workshop concluded and is contained within the Phase II Report Appendices. Monitoring objectives will be developed during Phase III and, therefore, are not included.

6.7 Hold Network meeting (with Science Committee) to review and critique proposed vital signs and monitoring objectives before presenting the final selection to the Board of Directors.

FY 03 Accomplishments: Because the vital signs selection process changed throughout the year, the Network presented the selected vital signs to the Board of Directors for preliminary approval before soliciting review and critique from the Science Committee. While this method may not be ideal, the BOD understood the difficulty in convening a Science Committee meeting. Therefore, the BOD gave approval of the selected vital signs with the knowledge that comments from the Science Committee would be integrated into the list, if possible, before the completion of the Phase II Report and that the BOD would be informed of these changes before they were made. Therefore, the critiques gathered from the Science Committee members were included in a special section at the end of the Phase II Report, and all changes were approved by the BOD.

Furthermore, during the Science Committee meeting, the Network Ecologist, Rob Bennetts, presented a proposed strategic framework for creating monitoring designs during Phase III. This framework was created from that proposed by Caughlan and Oakley (2001) with modifications to meet the specific needs of the Network. He emphasized the need to remove budgetary constraints as an *a priori* filter in the design and implementation process; instead, budgetary concerns will be considered throughout the process as a secondary filter. In addition, he explained the need for information synthesis in order to accurately identify tradeoffs due to funding limitations. This synthesis should also include any existing or potential issues and threats in the parks. Moreover, he explained the need to explicitly define the context in which the monitoring data could be used, including, for instance, informing scientists and managers about the health of the system, assisting in decision making and addressing a basic scientific need. In addition, he suggested that monitoring objectives should reflect the condition, state or dynamics to be measured, rather than the actions used to influence or measure that state. Thus, a monitoring objective sets a specific goal for attaining some ecological condition or change value, while a management objective sets a specific goal for the measurement of that value. Whenever possible, the monitoring objective will be linked to the management objective, if the management objective is already formulated. However, the GRYN will also continue to reevaluate the objectives, such that broad goals can continue to be met during times of technological or funding change.

6.8 *Park management reviews: solicit input from park resource managers and superintendents on selected vital signs and monitoring objectives through their participation in vital signs workshops and regular briefings.*

FY 03 Accomplishments: Park resource managers attended workshops in GRTE and YELL in order to peer review the vital signs selection process, identify threats and management issues and review the proposed candidate vital signs. The benefits of these workshops were two-fold: by having workshops at the parks, Network staff were able to get higher participation from park staff and, therefore, receive helpful comments that were used to strengthen the selection process; and by conducting park-specific workshops, Network staff were able to inform park managers of their presence and objectives, as well as create partnerships for future work. Park resource managers were also involved in the selection process through participation at the Vital Signs Monitoring Workshop and the Technical Committee vital signs selection meeting. Moreover, at least at YELL, resource branch chiefs were convened during smaller meetings in order to ensure sufficient input from all resource areas. Park superintendents (or assistant superintendents) were informed of the vital signs selection process through an executive summary written by Network staff and distributed by park managers. Furthermore, the Program Managers provided these BOD members with descriptions of the vital signs to ensure understanding of the scope of each vital sign. During a meeting in August 2003, the BOD had the opportunity to express concerns and comments about the vital signs selected and, afterwards, gave their approval of the list. BOD members were also contacted after a meeting of the Science Committee to address comments and concerns voiced by SC members.

7 Summarize and analyze existing information and concepts important for assessing current and future monitoring efforts and needs in the Network parks.

7.1 *Prepare synoptic reviews on vital signs monitoring themes to evaluate monitoring approaches, evaluate data sets, recommend opportunities for further analysis, describe protocols being used, recommend potential applications, describe opportunities for integration with park monitoring programs and describe opportunities for new partnerships.*

FY 03 Accomplishments: A first step toward these synoptic reviews was accomplished in FY 03 through the preparation of the technical notes for selected vital signs. These reports summarize the scope and importance of the vital sign, current monitoring, costs of monitoring and possibilities for cost-sharing opportunities with other agencies. A student assistant for the Network created a set of “Fact Sheets” containing information on organizations currently conducting monitoring in and around the Network parks. Furthermore, the Network has negotiated with the Western Center for Monitoring and Assessment of Freshwater Ecosystems at Utah State University about conducting a synoptic review of river invertebrate data and the development of monitoring protocols for the GRYN. The Network also collaborated with Henry Heasler and Cheryl Jaworowski of YCR to develop schematic and narrative conceptual models for the geothermal system. The Network is looking toward creating synoptic reviews on all selected vital signs during Phase III. For a list of synoptic reviews in progress, see task 7.3. The writer/editor did not complete a synoptic review of threatened and endangered species, as none were chosen as top priority vital signs for the Network.

7.2 Contract with David Selkowitz for climate data analysis and USGS (Don Campbell and Leora Nanus) to collect and analyze air quality and deposition for the three Network parks.

FY 03 Accomplishments: An existing contract with David Selkowitz through the RM-CESU was modified to secure his assistance in compiling and analyzing available climate data in the GRYN. In addition to providing the Network with GIS layers that include data on station type, location and length of record, Dave provided the Network with suggestions on the use of climate data as a vital sign and potential strengths and weaknesses of these data. For example, it was suggested that the National Climatic Data Center may offer more complete climate records than those he obtained through the Natural Resources Conservation Service. An even better repository for climate data corrected for station moves is the U.S. Historical Climate Network (although this information is no longer free to government agencies). Furthermore, it is his recommendation that the Network spend funds to ensure long-term datasets from existing stations instead of placing new stations and risking lack of funding to ensure long-term data collections in the future. The GRYN also created an interagency agreement with Leora Nanus and Don Campbell of the USGS to collect and analyze air quality and atmospheric deposition in the Network parks. This agreement was also conducted through the RM-CESU under the leadership of Kathy Tonnessen. This team provided the Network with data on air quality monitoring stations, identified potential “hot spots” and trends in air quality and atmospheric deposition and gave recommendations on using these indicators as vital signs. For instance, the team suggested that the GRYN consider continued monitoring of National Atmospheric Deposition Program/National Trends Network (NADP/NTN) and the Rocky Mountain Snowpack Chemistry Synoptic (RMS) on an annual basis as a priority at sites that are already established. Furthermore, they suggested that providing funds to the RMS synoptic snow survey sites would ensure long-term data collection, as RMS sites are currently funded on a yearly basis. Leora also attended the Vital Signs Monitoring Workshop in the climate/air quality workgroup. Both projects were completed and made available to staff and the Technical Committee when selecting vital signs.

7.3 Complete task agreements and interagency agreements through the RM-CESU to obtain the services of experts to complete synoptic reviews.

FY 03 Accomplishments: GRYN worked with Mark Williams of University of Colorado-Boulder to negotiate a task agreement to summarize historic water quality data on Soda Butte Creek in YELL and to perform synoptic samples of this site prior to recommending a long-term sampling design for this 303(d)-listed water. The review will focus on collating ecological parameters in and near Soda Butte into a single database and creating a one-time synoptic sampling scheme to document existing conditions on Soda Butte.

Through the modification of an existing contract with Dave Selkowitz, a review of climate station data throughout the Network was created. Dave gathered information on climate stations in the region, including station type, location and length of record. He

then performed a preliminary analysis on the data and submitted a report (see also task 7.2).

Chuck Peterson of Idaho State University will perform a synoptic review of all relevant amphibian data collected from 1991-2003 for all three parks, including ARMI surveys, NPS surveys and any other sources of information.

Mike Sweat of the USGS-WRD Wyoming District developed a plan to characterize seeps and springs within BICA as a basis for vital signs monitoring. This work began in FY 03 and is proposed to continue in FY 04, upon review of progress.

Steve Cherry, faculty in the Statistics and Mathematics Department at MSU, will conduct an analysis of existing whitebark pine data to help guide the development of a sampling design and field methods protocol. This work is being performed in collaboration with YCR, Yellowstone Resource Management and Visitor Protection, Interagency Grizzly Bear Study Team (IGBST) and the Greater Yellowstone Coordinating Committee (GYCC) with data collected by Katherine Kendall (USGS-Glacier Field Station) and Dan Tyers (USDA Forest Service) between 1995-2003.

7.4 Prepare narrative report of paleo resources in the Network parks.

FY 03 Accomplishments: Alison Koch and Vincent Santucci of Fossil Butte National Monument prepared a report summarizing the paleontological resources of BICA, GRTE and YELL. This report (cited in section IV) contains specific information on resources found, as well as a synopsis of relevant literature and datasets available to the Network. Resources found within the parks include: fossil pollen, spores, marine and freshwater mollusks, dinosaurs, mammals and petrified wood. In addition to detailing specific resources found at the parks, the report also gives a synopsis of the fossiliferous formations found within the parks.

7.5 Install a weather station at BICA.

FY 03 Accomplishments: Laura Gianakos (Network ecologist) and maintenance staff from BICA and YELL installed a Remote Automated Weather Station (RAWS) northwest of Barry's Landing in BICA. This represents the mid-line of weather conditions in the park. Previously, the closest recorded climate data had to be collected from Britton Springs to the south or Billings, MT from the north. The data from the station will inform park visitors of conditions for recreational purposes, determine local fire and range conditions and monitor climate. Data collected includes precipitation, wind speed and direction, temperature and relative humidity, fuel temperature and moisture, barometric pressure and solar radiation. This information is collected on an hourly basis and archived at several interagency fire dispatch centers and National Weather Service regional climate centers. It can also be accessed at www.met.utah.edu/mesowest/ by entering Zip code 82431 or Station ID HBOM8.

FY03 ACCOMPLISHMENTS FOR WATER QUALITY MONITORING PROGRAM

8 Summarize and analyze existing information and concepts important for assessing current and future water quality monitoring efforts and needs in the Network parks.

8.1 *Formalize GRYN core water quality working group.*

FY 03 Accomplishments: The core water quality work group was formalized at a meeting in Bozeman, MT, on October 28-30, 2002. Group members included Susan O’Ney (leader), Laura Gianakos, Jeff Arnold, Todd Koel and Kathy Tonnessen. During FY 03, the group focused on several topics, including: 1) the development of and solicitation for requests for proposals for projects such as protocol development, synoptic studies, technical assistance requests for study plans, statistical frameworks/designs; 2) summarizing management issues and stressors related to water quality; 3) summarizing current water quality monitoring efforts; 4) a review of available field protocols for NPS-WRD “core parameters”; and 5) the development of monitoring objectives for impaired, or 303(d) listed, waters within Network parks.

8.2 *Complete Woods Report and data analysis.*

FY 03 Accomplishments: Network 303(d) streams and ONRWs were identified in the GRYN Phase II Report submitted to the Science Committee for peer review. A draft of the WQ Phase II Report was submitted to Bill Jackson (NPS-WRD) for review. Scott Woods and Jennifer Corbin submitted their completed Vital Signs Water Quality Monitoring for the Greater Yellowstone Network Reports for BICA, GRTE and YELL. For the purpose of these reports, STORET and Horizon data were analyzed to: 1) review the data for their utility in determining the status and trends in water quality; 2) determine the status and trends and the range of variability in water quality; 3) identify and prioritize water quality monitoring needs in accordance with the goals of the vital signs monitoring program; and 4) identify pollutants that exceed water quality standards. To facilitate data analysis, each data record was assigned to one of thirteen parameter groups representing thirteen of the fourteen “Level 1” parameters identified as those that all parks must have for “key” water bodies (National Park Service 1993). Each record in the database was compared to state and federal water quality standards such that historical and existing water quality problems could be identified.

9 Implement and maintain an integrated GIS and data management program for water quality data.

9.1 *Conduct data mining, database review, compilation and analysis of existing water quality data.*

FY 03 Accomplishments: Data mining activities for FY03 included: Scott Woods’ Vital Signs Water Quality Monitoring for the Greater Yellowstone Network; a project related to Soda Butte Creek in YELL, which is a collaboration between the University of Colorado-Boulder and the Region 8 of the US Environmental Protection Agency (EPA); a project to develop an aquatic ecosystem risk assessment in Greater Yellowstone and Grand Teton National Parks and to develop predictive models of surface water quality in high-altitude lakes for each park by relating existing water quality data to basin

characteristics and atmospheric deposition data; and a surface water classification project, described in detail below.

The surface water classification project started with a literature review of methods used to classify surface waters (lakes, streams, rivers) and, from this review, a methodology of classifying level 6 watersheds into groups that will respond similarly to factors that affect water quality was determined. Staff at YCR built a level 6 Hydrologic Unit Code (HUC) layer for the entire GRYN. The study area boundaries for the project include all of the level 6 watersheds that flow into or out of each park. Network-wide data layers were created for topography, precipitation, land-use/vegetation and geology. In support of the surface water classification project, the following GIS themes were compiled by staff supervised by Ann Rodman at Yellowstone Center for Resources:

Watersheds (HUC levels): Level 6 HUCs were compiled for the areas within and surrounding each park. This includes more than 1,948 watersheds. We are currently completing the metadata and QAing the spatial/attribute data.

Precipitation: We have clipped precipitation data (averages from 1961 through 1990), created by Natural Resource Conservation Survey and Oregon State University, to create a GRYN coverage. The metadata are almost complete.

Land Use / Land Cover: Land use and land cover (LU/LC) data, collected by the USGS NMD, was used to create a GRYN coverage. This information is from the late 1970s and early 1980s. It is useful for environmental assessment of land use patterns with respect to water quality analysis, growth management, and other types of environmental impact assessments. It is based on a hierarchical system with two levels.

Township and Range Boundaries: A coverage of Township and Range sections was created for the areas surrounding each park. Historical data and information collected by other agencies is often based on Township and Range locations. This coverage will allow us to link to that data and view it spatially.

To adequately implement the water quality and assessment objectives, a contiguous geology layer needed to be created for the GRYN that extends beyond administrative boundaries. Data sources outside NPS were used to obtain the necessary information. Statewide coverages were obtained for Wyoming (<http://www.wygisc.uwyo.edu/clearinghouse/>) and Montana (<http://nr.is.state.mt.us/>) from data clearinghouses and were then edge matched. A GYE geology coverage from Gallatin National Forest and the Greater Yellowstone Coordinating Committee were used to fill in missing areas in Idaho.

9.2 Continue to incorporate new water quality datasets from ongoing research activities into Dataset Catalog, NatureBib, etc.

FY 03 Accomplishments: Thirteen water quality related datasets were identified that are not currently in Dataset Catalog. An existing dataset for lakes at YELL was identified to

be digitized, entered into the NPS-Water Resources Division (WRD) water quality database template and into Dataset Catalog.

9.3 Coordinate with data manager to develop Standard Operating Procedures (SOPs) for efficiently capturing these data in the GRYN.

FY 03 Accomplishments: A Data Manager for the GRYN was not hired until the end of FY 03. However, the most recent version of the NPS-WRD Water Quality Database Template was distributed to the GRYN Technical Committee and core water quality workgroup for review and discussion at the October 28-30, 2002 meeting in Bozeman.

9.4 Insure that all Network-supported water quality data utilize the water quality database template developed by NPS-WRD.

FY 03 Accomplishments: At GRTE, a backcountry water quality dataset was converted from an excel spreadsheet to an ACCESS database that met minimum NPS-WRD database requirements.

9.5 Develop and maintain strategies to share information with Network parks, scientists and others interested in the Network's I&M program 03 accomplishments.

9.5.1 Contact other Networks to compare water quality monitoring strategies.

FY 03 Accomplishments: Online water quality plans for other Networks were reviewed. These included plans for the Cumberland Piedmont Network, the Northern Colorado Plateau Network, North Cascades Long-Term Ecological Monitoring (LTEM), the Prairie Cluster and the Great Smokey Mountains NP.

10 Identify and prioritize all water quality indicators; develop/review/evaluate protocols; and implement programs to monitor the vital signs.

10.1 Identify and implement pilot projects.

FY 03 Accomplishments: A call for pre-proposals was issued early in February 2003 for water quality related projects. As a result of this call, three projects were funded by the GRYN. These included a synoptic study of Soda Butte Creek and two watershed classification studies – one with an emphasis on high-elevation lakes and one directed at a more general 6th-level HUC classification. Late this fiscal year, funds were obligated to Utah State University (Chuck Hawkins) to review available data and assist in protocol development for monitoring benthic macroinvertebrates (a selected GRYN vital sign).

The proposal for Soda Butte Creek (a GRYN 303(d) stream) is a collaboration between the University of Colorado-Boulder and Region 8 of the US Environmental Protection Agency (EPA). Both the University of Colorado-Boulder and the EPA provide significant in-kind financial contributions. Historical information about ecological parameters in and near Soda Butte Creek is being collated into a single database to help design an effective monitoring strategy. In addition, the investigators will conduct a one-time synoptic sampling to document existing conditions. The synoptic sampling effort will consist of an integrated effort in the collection of chemical data (e.g., water quality parameters, surface water analysis of contaminants and nutrients), physical data (e.g., habitat metrics such as channel mean depth and width, substrate stability and canopy cover) and biological data (e.g., fish, benthic macroinvertebrates and periphyton).

Collecting this type of data and comparing them to reference and historical data will provide the foundation for developing a long-term monitoring strategy. The synoptic sampling will be conducted by all PIs following protocols in Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, Periphyton, Benthic Macroinvertebrates, and Fish (EPA 841-B-99-002). For example, metal analysis will follow EPA guidelines: ICP both simultaneous and dual view ICP (EPA Method 200.7) and Graphite furnace (EPA Method 200.9). Sample sites will be located with input from the NPS. All sample analyses will be compatible and comparable with the EPA Environmental Monitoring and Assessment Program (EMAP). Region 8 has been involved over the last few years with a western-wide pilot for EMAP, under the direction of Patti Tyler. Because our techniques are compatible with EMAP, we will use this dataset to assess the ecological condition of Soda Butte Creek with respect to other streams throughout the West sampled as part of EMAP. Specific measurements include:

- Longitudinal survey of Soda Butte Creek for trace metal and solute content
- Longitudinal survey of sediments in Soda Butte Creek for trace metal and solute content
- Habitat assessment
- Invertebrates
- Toxicity testing if metal concentrations exceed ambient water quality standards
- Metals content of fish tissue

The EPA will conduct all analyses (except fish tissue)-physical, chemical, and biological- and charge the cost internally as an in-kind contribution of about \$50,000, depending on the number of sites sampled. Sample analyses will be conducted at the EPA Region 8 Laboratory in Golden, CO. The EPA will investigate working with Wyoming DEQ to analyze the fish tissue. Mike Wireman and Patti Tyler of the EPA will also contribute one-half month each of their salaries to this project.

10.2 *Review pilot studies (if implemented).*

FY 03 Accomplishments: The GRYN is awaiting completion reports for a reference reach study conducted by the USFS and a macroinvertebrate study conducted by YELL staff.

10.3 *Develop several Fee Demo or other NRPP proposals to augment knowledge of Network water resources.*

FY 03 Accomplishments: Two GRYN related projects were submitted for the USGS Water Quality Assessment and Monitoring funding source as part of the FY 03 Special Emphasis Program Allocation System (SEPAS) call. These included a proposal for evaluation of lake sediments in BICA, GRTE and YELL and an inventory of springs and seeps in BICA. These proposals were not funded. A second (and final) year of funding was completed for a synoptic study of five Snake River tributaries, as part of the Water Resources Division – Competitive funding source. GRTE submitted a request and received Fee Demo funding for a study to develop monitoring protocols for fecal coliform in backcountry waters.

10.4 *Hold water quality planning workshops/meetings to help formulate questions to be answered and develop monitoring objectives for water quality.*

FY 03 Accomplishments: During FY 03, several meetings (both face-to-face and conference calls) were held by the GRYN core water quality workgroup. Summaries of meeting accomplishments are as follows:

- 10/28-30/02: Bozeman, MT. The core water quality work group was formalized; topics were suggested for pilot studies
- 12/16/02: Conference call. Discussed current park water quality monitoring; reviewed results of Delphi II and preliminary Scott Woods findings; discussed individual park themes (emphasis areas)
- 2/19/03: Conference call. Reviewed responses to request for proposals. Rated proposals. Selected proposals to forward to Technical Committee for approval.
- 4/10/03: Conference call. Discussed and worked on the development of monitoring objectives for impaired and pristine waters.
- 7/3/03: Conference call. Reviewed draft of water quality monitoring plan. Provided suggestions and comments for improvement.
- 8/7/03: Yellowstone Lake. Discussed the role of the Western Center for Monitoring and Assessment of Freshwater Ecosystems in macroinvertebrate monitoring for the GRYN, protocol development and proposals for monitoring water quality in the GRYN. Several of the GRYN water quality related vital signs were refined (Major Ion Chemistry changed to Water Chemistry; Total Suspended Sediment moved from water chemistry to Stream Sediment Transport). Probabilistic versus fixed sampling strategies were discussed.

10.5 *Prepare draft water quality monitoring objectives ("strawman" monitoring proposal) for peer review and BOD approval.*

FY 03 Accomplishments: As part of the Water Quality Phase II Report, the monitoring objectives for impaired waters (303(d) streams) were prepared and are ready for peer review.

10.6 *Participate in Vital Signs Monitoring Workshop.*

FY 03 Accomplishments: Members of the core water quality work group participated as part of the group that applied the selection criteria to water-related vital signs at the May 2003 Vital Signs Monitoring Workshop in Bozeman, MT.

10.7 *Participate in Science Committee meeting.*

FY 03 Accomplishments: Members of the core water quality work group participated in the September 22-24, 2003 Science Committee Meeting in Chico Hot Springs.

10.8 *Review/evaluate existing protocols (USGS, EPA, States) relevant to approved water quality monitoring objectives.*

FY 03 Accomplishments: Existing protocols (USGS, NPS-WRD, EPA, WY, MT) for the five core parameters were reviewed. Additional protocols are reviewed as specific monitoring objectives are developed.

FY04 SCHEDULED ACTIVITIES FOR INVENTORY PROGRAM

1 Create and maintain information-sharing strategies in an effort to integrate the I&M Program into park activities and facilitate manager use of collected information.

- 1.1 Prepare monthly newsletters for distribution to Network parks and cooperators. Announce new products and provide hyperlinks to web products.*
- 1.2 Prepare and publish biological inventory, vital signs planning reports and other products and ensure each I&M report or publication is delivered to each Network park, the I&M Program Manager, the Intermountain Support Office and the WASO office.*
- 1.3 Maintain and update GRYN website as a place where park staff, scientific communities and the public sector (with consideration of sensitive data availability) can learn more about the GRYN and obtain copies of study products, reports and publications.*
- 1.4 Keep Service-wide databases current with I&M Program results (NPSpecies, NatureBib, Dataset Catalog); build and store data using the database template.*

2 Develop, implement and maintain an integrated plan for data management in the Network (including inventory and monitoring components of the program)

- 2.1 Prepare a draft data management plan that includes strategies for Network-wide data sharing, archiving, documentation, acquisition and stewardship. Evaluate the NBII as a means of Network-wide data sharing.*
- 2.2 Sponsor one or more GRYN data management workshops to review status of datasets, identify data gaps, prioritize data acquisition projects and advise on Network data management planning.*
- 2.3 Implement quality control/quality assurance and updating procedures in NatureBib. Review and correct entries and edit/correct to comply with data standards. Archive and/or delete records that are duplicate, incomplete or inappropriate. Fill in topic data gaps identified during literature review and add new publications as they become available. Develop and apply a key word standard.*
- 2.4 Develop Standard Operating Plans for efficient data capture. Assign data management staff to visit each Network park to gather and input new records for the vital signs monitoring program into NatureBib, NPSpecies and Dataset Catalog as appropriate.*
- 2.5 Complete a work plan for converting to a GIS hydro-geo model and work with staff at Yellowstone Spatial Analysis Center to complete a pilot effort. Other projects include color balance GRYN composite LANDSAT imagery; perform*

quality assurance on hydrography data and compare to National Hydrography Dataset; complete acquisition and assembly of transportation/access data (roads and trails); complete Surface Water Classification project.

3 Describe the distribution and relative abundance of vertebrate and vascular plant species, targeted species, taxonomic groups and/or species assemblages that are of special concern to GRYN network parks.

3.1 Implement inventory projects identified and scheduled in the Vertebrate and Vascular Plant Inventory Study Plan. Prepare a work plan and complete agreements for the Yellowstone Cutthroat Trout Inventory in the Upper Snake River Drainage. Non-permanent staff, supervised by Steve Haynes at GRTE, will complete the non-native vascular plant inventory at GRTE. Non-permanent staff, supervised by Mary Hektner at YELL, will complete the Alpine Vascular Plant Inventory at YELL. Other planned inventories were prefunded with FY03 funds (see table 1).

3.2 Prepare a synoptic inventory report for exotic plant species in the GRYN. Compile and analyze available and relevant data sets in conjunction with, and to facilitate the development of monitoring objectives and design. Develop a position description and prepare task agreement with Big Sky Institute. Fund Leslie Frattaroli (a non-permanent employee at GRTE) for one pay period to assemble relevant GRTE data sets for the Network report.

3.3 Complete a review and certification of the NPSpecies Database (according to Service-wide standards) for accuracy and completeness. Develop a scope of work/work plan and assign a University student botanist to assist with the vascular plant component.

3.4 Secure housing for cooperators working in the Network parks. Help locate and fund housing for non-native plant and bat inventory crews.

4 Maintain an administrative and organizational framework for the GRYN Inventory, Vital Signs and Water Quality Monitoring Programs.

4.1 Assure adherence to established NPS Service-wide and generally accepted scientific standards, including quality assurance and quality control on inventory data and reports.

4.2 Assure adherence to established Service-wide fiscal, National Environmental Policy Act (NEPA), research permitting and other compliance, data management and reporting standards.

4.3 Establish templates for products, such as progress and final reports, and ensure deliverables follow the template.

4.4 Establish data storage, archival headquarters and/or institutional library for the network.

FY04 SCHEDULED ACTIVITIES FOR VITAL SIGNS MONITORING PROGRAMS

5 Identify specific monitoring objectives associated with each vital sign, starting with those listed as high priorities.

- 5.1 *Conduct interviews with parties both internal and external to NPS with expertise of monitoring specific vital signs, and/or with management responsibilities that would benefit from use of information derived from monitoring specific vital signs.*
- 5.2 *Synthesize the information needed to formulate specific monitoring objectives, including management objectives, issues, threats, potential decisions influenced by information derived from monitoring specific vital signs and legal mandates.*
- 5.3 *Based on information described above, formulate draft monitoring objectives and workshops or alternative forums with relevant parties (described above) to review and refine draft monitoring objectives.*
- 5.4 *Plan and sponsor a workshop on weather and climate monitoring in the GRYN to share information and help guide the development of a long-term climate-monitoring program.*
- 5.5 *Initiate reviews by the Science and Technical Committees and Board of Directors of proposed monitoring objectives. Hold two Science Committee meetings to solicit peer review and guidance on program. Fund BICA Natural Resource Specialist 4 pay periods to participate in meetings and oversee the planning and implementation of the I&M program at BICA.*

6 Develop sampling designs for those monitoring objectives approved by the Board of Directors.

- 6.1 *Synthesize the information needed to develop sampling designs, including sampling and process variation (from review of existing data), spatial and temporal scopes of interest, desired type I and II error rates.*
- 6.2 *Work with statisticians and relevant parties to develop sampling designs that effectively meet the intended vital signs monitoring objectives. Complete a \$20,000 task agreement to again the support of the Math and Statistics Department at Montana State University for statistician services. Complete a \$25,000 interagency agreement with John Sauer and Larissa Bailey of Patuxent Wildlife Research Center, Laurel, MD for consultation in the planning, monitoring objectives, sampling design and analysis protocols for monitoring land bird and amphibian monitoring in the GRYN.*
- 6.3 *Develop alternative sampling design packages for each vital sign such that the costs and feasibility of implementation can be considered in light of tradeoffs between exclusion and exclusion of specific monitoring objectives, tradeoffs in spatial and/or temporal extent, and/or tradeoffs in levels of precision or type II error rates.*

Phase III Planning Schedule for first dozen Vital Signs. 1 = fall 2003, 2 = winter 2004, 3 = spring 2004, 4 = summer 2004, 5 = fall 2004, 6 = winter 2005, 7 = spring 2005, 8 = summer 2005)

Vital Signs Phase III December 2004	I-III		IV Sampling Design	V Sampling Protocols	VI: Data Mgt	VII: Data Analysis & Reporting	VIII: Administration/ Implementation Plan	IX: Schedul e	X: Budget
Protocol content	Part 1: Background Information and Monitoring objectives		Part 2: Sampling Design	Part 3 Field Methods	Part 4: Data Handling, Analysis & Reporting	Part 5: Personnel Requirements and Training	Part 6: Operational Requirement s		
	Info synthesis	Monitoring objectives							
Amphibians	1, 2, 3, 4	2	3	2,3,4	2,3,4,5		2,3,4,5		2,3,4,5
	In FY03, \$13,500 with Chuck Peterson (ISU) for help with data analysis and monitoring objectives and \$42,998 to pilot field design. In FY04, \$5,000 IA with Larissa Bailey of Patuxent Wildlife Research Center for help with design and analysis issues								
Climate	1, 2, 3, 4	5	6	6,7,8	8		8		8
	In FY03, \$5,280 for David Selkowitz to compile and analyze available GRYN climate data. In FY 04, \$40,000 task agreements for help with climate monitoring objectives, workshop and protocols.								
Exotic Aquatic Assemblage	1, 2, 3, 4	6	6	6,7,8	6,7,8		6,7,8		6,7,8
	In FY04, compile information on aquatic threats and issues to facilitate the development of monitoring objectives and design with a CESU partner.								
Exotic plants	1, 2, 3, 4	6	6	6,7,8	6,7,8		6,7,8		6,7,8
	In FY04, \$20,000 for Big Sky Institute project coordinator to work on exotic plant monitoring plan. \$10,000 set aside for cooperation with proto-type program; 2,500 for GRTE term for data stewardship.								
Chloride flux	1, 2, 3, 4	2	3	2,3,4	2,3,4,5		2,3,4,5		2,3,4,5
	In FY04, \$15,000 to C. Jaworawski to compile, organize and update chloride flux monitoring protocols to I&M requirements								
Land birds	1, 2, 3, 4	2	3	6,7	6,7		6,7		6,7
	In FY04, \$20,000 IA with John Sauer of Patuxent Wildlife Research Center for help with design and analysis issues								
Land-use	1, 2, 3, 4	3	5	3,4,5	3,4,5		3,4,5		3,4,5
	In FY04, \$49,983 to Andy Hansen, MSU for help with monitoring objectives and monitoring protocols								
Aquatic invertebrate s	1, 2, 3, 4	3	4	3,4	3,4,5		3,4,5		3,4,5
	In FY02, \$31,925 for YELL to complete synoptic network wide sampling. In FY03, \$10,000 task agreement with C.P. Hawkins at USU to synthesize background and prepare work plan. In FY04, \$25,000 set aside for task agreement to help with design and analysis issues								
Springs and seeps	1, 2, 3, 4	2	5	4,5,6	6,7		6,7		6,7
	In FY03, \$15,800 to USGS WRD Cheyenne, WY to compile background information and prepare an I&M work plan. In Fy04, \$40,000 for monitoring objectives and monitoring protocols.								
Stream flow	1, 2, 3, 4	3	3	2,3	3,4,5		3,4,5		3,4,5
	In FY04, a needs assessment by network staff and invited guests is planned								
Water chemistry	1, 2, 3, 4	3	4	2,3,4	3,4,5		3,4,5		3,4,5
	In FY01/02, \$39,000 for Scott Woods (MSU) to compile and analyze water quality data. In FY03, \$25,000 for an aquatic risk assessment, \$24,760 for Soda Butte monitoring strategy and \$11,000 for a surface water classification. In FY04, \$40, 000 to WQ experts to help with monitoring objectives and monitoring protocols.								
Whitebark pine	1, 2, 3, 4	3	4	2,3,4,5	2,3,4,5		2,3,4,5		2,3,4,5
	\$20,000 for Big Sky Institute project coordinator to work on whitebark pine monitoring plan								

- 7 Develop protocols in accordance with the guidelines of the NPS I&M Program.**
- 7.1 *Work with internal and external cooperators to complete all or part of the monitoring protocols for top priority vital signs. Enter into task agreements or interagency agreements with cooperators, for example 1) Western Center for Monitoring and Assessment of Freshwater Ecosystems at Utah State University for “river invertebrate assemblages” vital sign, 2) Andy Hansen at Montana State University for “land-use change” vital sign, 3) USGS Patuxent Wildlife Research Center for “land birds” vital sign, 4) USGS Wyoming District, Water Resources Division for “seeps and springs vital sign. Solicit for and choose cooperators to help with 1) climate objectives and protocol development, and 2) water chemistry objectives and sampling design.*
- 7.2 *Develop quality control and quality assurance standard operating procedures. Assign Jeff Arnold (non-permanent YELL staff) a task to conduct pilot water quality field studies to evaluate QC/QA procedures. (see also task 10.4)*
- 7.3 *Continue to solicit and receive peer review on all facets of the Vital Signs Monitoring Program from internal and external sources. Identify specific subject-area experts who will peer review; compensate reviewers using task agreements, interagency agreements or personal services contracts.*
- 7.4 *Compile and produce Phase III of the Vital Signs Monitoring Plan. Modify existing contract or prepare new contract with Writer/Editor.*
- 8 Develop a strategy for leveraging funds from outside sources to enhance the monitoring capabilities of the Network.**
- 8.1 *Develop a proposal to receive NASA cooperation for remote sensing data and environmental monitoring.*
- 8.2 *Develop a schedule of proposal due dates and qualifications to which the Network can apply for funding.*

FY04 SCHEDULED ACTIVITIES WATER QUALITY MONITORING PROGRAM

- 9 Summarize and analyze existing information and concepts important for assessing current and future water quality monitoring efforts and needs in the Network parks.**
- 9.1 *Work with internal and external cooperators to help with the development of water quality monitoring objectives (see also task 7.1)*
- 9.2 *Statistically determine appropriate sample size/monitoring frequencies to meet these objectives.*
- 10 Implement and maintain an integrated GIS and data management program for water quality data.**
- 10.1 *Conduct additional data mining, database review, and compilation and analysis of existing water quality data. Obtain the YELL lakes datasets.*

10.2 *Continue to incorporate new water quality datasets from ongoing research activities into Dataset Catalog, NatureBib, etc. Review the NPS Research and Reporting System for recent/current projects related to water quality. Enter those datasets into Dataset Catalog. Acquire datasets that the GRYN determines should be entered into the water quality database template.*

10.3 *Coordinate with Data Manager to develop an SOP for efficiently capturing these data in the GRYN.*

10.4 *Familiarize new Data Manager with NPS-WRD water quality database template and develop additional water quality data relevant to the Network. Assign Jeff Arnold the task of compiling past YELL water monitoring data (2002-2003) into a NPS STORET database.*

10.5 *Ensure that all Network-supported water quality data utilize the water quality database template developed by NPS-WRD. This would include the Forest Service reference reach study, the YELL macroinvertebrate study and the Soda Butte synoptic study.*

10.6 *Develop and maintain strategies to share information with Network parks, scientists and others interested in the GRYN program. Contact other Networks to compare water quality monitoring strategies.*

11 Develop protocols for regulatory 303(d) monitoring; have protocols peer reviewed; implement peer reviewed monitoring protocols.

11.1 *Have monitoring objectives for Shoshone River, Bighorn River and Reese Creek peer reviewed as part of the Phase II Water Quality Monitoring Report.*

11.2 *Review results and recommendations from Soda Butte synoptic study; prepare monitoring objectives and have objectives peer reviewed.*

11.3 *Contact the states (WY, MT) to determine which protocols would be acceptable for regulatory monitoring purposes.*

11.4 *Review/evaluate existing protocols (USGS, EPA, states) relevant to approved water quality monitoring objectives.*

11.5 *Propose a sampling design in consultation and coordination with the vital signs sampling design (see objective 6.2).*

Compile complete protocol for monitoring GRYN 303(d) water bodies (including introduction and background, monitoring objectives, sampling design, field methods, data handling and analysis) and have protocol peer reviewed.

II. Staffing

Inventory and Monitoring Staff

Cathie Jean, Greater Yellowstone Network I&M Program Manager	GS 12/13
Rob Bennetts, Ecologist, Greater Yellowstone Network	GS 12
Rob Daley, Data Manager, Greater Yellowstone Network	GS 12
Susan O'Ney, Hydrologist, Grand Teton National Park (0.5 FTE)	GS 11
Chad Jacobson, Cartographic Technician, Greater Yellowstone Network	Term GS 7
Laura Gianakos, Ecologist, Greater Yellowstone Network (resigned)	Term GS 9/11

Board of Directors

Frank Walker, Assistant Superintendent	Yellowstone National Park
Steve Cain, Supervisory Wildlife Biologist (Acting)	Grand Teton National Park
Darrell Cook, Superintendent (Chair)	Bighorn Canyon NRA
Bruce Bingham	Intermountain Region I&M Coordinator
Kathy Tonnessen	Rocky Mountains Cooperative Ecosystem Studies Unit

Technical Committee

Tom Olliff (Chair)	Yellowstone National Park
Ann Rodman	Yellowstone National Park
Rick Lasko (Acting)	Bighorn Canyon National Recreation Area
Kathy Tonnessen	Rocky Mountains Cooperative Ecosystem Studies Unit
Steve Cain	Grand Teton National Park
Cathie Jean	I & M Program Manager, Greater Yellowstone Network

Science Committee

Duncan Patten	Research Professor, Big Sky Institute, Montana State University
Lisa Graumlich	Executive Director, Big Sky Institute, Montana State University
Michael Ivie	Affiliate Director, Department of Entomology, Montana State University
Joel Berger	Senior Field Ecologist, Wildlife Conservation Society
Timothy Kittel	Research Affiliate, Institute of Arctic and Alpine Research, University of Colorado

Cooperators

Scott Woods, University of Montana - Water Quality Data Mining and VSM Recommendations (FY03)

Ed Krump & Troy Hall, University of Idaho - Delphi, A Survey of Science Professionals (FY03)

Bruce Maxwell & Lisa Rew, Montana State University - Exotic Plant Distribution YELL Northern Range (FY03 and 04)

Gary Beauvais University of Wyoming - Bat and Small Mammal Inventories (FY03 and 04)

Rob Gipson, WY Game & Fish - Fish Inventory of Alpine Lakes in GRTE (FY03 and 04)

Charles Peterson, Idaho State University - Amphibian & Reptile Inventory (FY03 and 04)

Lisa Graumlich, Montana State University - VSM Planning and Support (FY03 and 04)

Duncan Patten, Montana State University - Conceptual Model Development (FY03 and 04)

Bob Hall, University of Wyoming, - Aquatic Conceptual Model Development (FY03)

Dan Tinker, University of Wyoming - Forest Ecosystems Conceptual Model Development (FY03)

Don Campbell and Leora Nanus, USGS-WRD - Air Quality and Deposition Data Analysis (FY03)

David Selkowitz, Contractor - Compilation and analysis of snow and climate data (FY03)

Steve Cherry, Montana State University-Whitebark pine data (FY03 and 04)

Chuck Hawkins, Utah State University-River invertebrate assemblages (FY03 and 04)

Mike Sweat, USGS-WRD Cheyenne-Seeps and springs (FY03 and 04)

Park Contributors

Suzanne Morstad, NPS-BICA - NPSpecies (FY03 and 04)

Sue Wolff, NPS-GRTE - Bald Eagle & Sage Grouse Surveys GRTE (FY03)

Jeff Arnold, NPS-YELL - Water quality work group planning participant (FY03)

Todd Koel, NPS-YELL - Water quality work group planning participant (FY03)

Ann Rodman NPS-YELL - Boundary Stressors Data Collection (mining and exploration)

Steve Haynes, NPS-GRTE - Exotic Plant Distribution -GRTE (FY03 and 04)

Hank Heasler and Cheryl Jaworowski, NPS-YELL - Geothermal conceptual model development (FY03)

Glenn Plumb, NPS-YELL - Ecosystem conceptual model development (FY03)

Jennifer Whipple, NPS-YELL - Vascular plant inventory in YELL alpine areas (FY03 and 04)

Mary Hektner, NPS-YELL – Vascular plant inventory in YELL alpine areas (FY03 and 04)

IV. Reports, Publications and Presentations

Reports

- Koch AL and Santucci VL. 2003. Paleontological resource inventory and monitoring: Greater Yellowstone Network, June 2003. National Park Service, TIC #D-1025. Greater Yellowstone Network, Bozeman, MT.
- Nanus L and Campbell DH. 2003. Analysis of air quality information for vital signs selection. National Park Service. Greater Yellowstone Network, Bozeman, MT.
- Patla DA and Peterson CR. 2003. Amphibian and reptile inventory and monitoring, Greater Yellowstone Network, Grand Teton and Yellowstone National Parks, Progress Report 2003, March 9, 2003. National Park Service. Greater Yellowstone Network, Bozeman, MT.
- Rew LJ, Maxwell BD, Dougher FL, Aspinall R, Weaver T, Despain D and Sheley R. 2003. A survey of non-indigenous plant species in the northern range of Yellowstone National Park, 2002 Annual Report, March 26, 2003. National Park Service. Greater Yellowstone Network, Bozeman, Montana.
- Selkowitz D. 2003. Compilation and analysis of climate data in the Greater Yellowstone Ecosystem/Bighorn Canyon area: completed products, problems encountered and recommendations for the future, June 16, 2003. National Park Service. Greater Yellowstone Network, Bozeman, MT.
- Woods SW and Corbin J. 2003. Vital signs water quality monitoring for the Greater Yellowstone Network: Bighorn Canyon National Recreation Area: Final Technical Report, July 2003. National Park Service. Greater Yellowstone Network, Bozeman, MT.
- Woods SW and Corbin J. 2003. Vital signs water quality monitoring for the Greater Yellowstone Network: Grand Teton National Park: Final Technical Report, August 2003. National Park Service. Greater Yellowstone Network, Bozeman, MT.
- Woods SW and Corbin J. 2003. Vital signs water quality monitoring for the Greater Yellowstone Network: Yellowstone National Park: Final Technical Report, September 2003. National Park Service. Greater Yellowstone Network, Bozeman, MT.

Presentations

- October 8, 2002. Greater Yellowstone Coordinating Committee. NPS Natural Resource Challenge Inventory and Monitoring Program. Jackson Hole, WY. Cathie Jean.
- February 20, 2003. Intermountain Region Inventory and Monitoring Meeting. Developing Monitoring Objectives. Tucson, AZ. Cathie Jean.
- August 20, 2003. National I&M Meeting. Case Study: Vital Signs Monitoring in the Greater Yellowstone Network, Phase II. Landsdowne, Virginia. Cathie Jean.
- November 5, 2002. Intermountain Region General Management Conference. Panel participation: partners in understanding and documenting resources. Salt Lake City, UT. Cathie Jean.
- September 23, 2003. GRYN Science Committee Meeting 2003. Strategic Framework for Developing Monitoring Objectives. Chico Hot Springs, MT. Rob Bennetts.
- February 20, 2003. Intermountain Region Inventory and Monitoring Meeting. Useful Conceptual Ecological Models. Tucson, AZ. Glenn Plumb.
- January 30, 2003. Exotic Weed Workshop. BICA Weed Inventory. Bozeman, MT. Laura Gianakos.

V. Status of Park Vital Signs Monitoring

Table 3. Status of natural resource monitoring programs during FY03. The numbers indicate the parks within GRYN that have monitoring activities (planning and design, implementing protocols, and/or analysis/synthesis of monitoring data) taking place using Natural Resource Challenge (NRC) funds or other sources of funds.

Greater Yellowstone Network	Air Quality	Water Quality	Water Quantity	Geologic Resources	Plants	Animals	Landscape Characteristics
Planning and Design							
# parks monitoring w/ NRC funding	3	3	3	3	3	3	3
# parks monitoring w/ other funding	2	2	3	1	3	3	2
Protocols Implemented							
# parks monitoring w/ NRC funding	0	0	0	0	0	0	0
# parks monitoring w/ other funding	2	2	3	1	3	3	2
Analysis/Synthesis Available							
# parks monitoring w/ NRC funding	0	0	0	0	0	0	0
# parks monitoring w/ other funding	2	2	2	1	3	3	2

Note: Air (YELL, GRTE), Water quality (YELL, GRTE), Water Quantity (YELL, GRTE, BICA), GEO (YELL), Plants (YELL, GRTE, BICA), Animals (YELL, GRTE, BICA), Landscape Characteristics (YELL, GRTE, BICA).

This table shows that in FY03 all three parks are planning for vital signs using NRC funds and are considering all 7 monitoring categories. The GRYN has many on-going monitoring projects funding through sources other than NRC dollars. This includes monitoring taking place by external cooperators and/or researchers. This table assumes that planning and design is a continuous process, therefore the number in the planning and design field parallels those in the implementation and analysis field

USGS Protocol Development and Monitoring-Related Research Needs

The Network would like to participate with the following USGS scientists to assist in monitoring planning, design, database design, review or revision of existing protocols. These are listed in order of priority.

- Planning and development of objectives and protocols for monitoring land birds.
 - John Sauer of Patuxent Wildlife Research Center, Laurel, MD
- Planning and development of objectives and protocols for monitoring seeps and springs distribution and abundance.
 - Mike Sweat of Wyoming District WRD, Cheyenne, WY
- Remote sensing applications for land-use change.
 - Tom Loveland of Earth Resources Observations Systems, Sioux Falls, SD
- Planning and development of objectives and protocols for monitoring fire, fuels and carbon storage.
 - Carl Key of Northern Rocky Mountain Science Center, West Glacier, MT

VI. Budget

In FY 03 the Network received full funding for the Vital Signs Monitoring Program, with \$724,670. The GRYN also received \$36,000, in addition to \$136,500 for inventories, for a vegetation mapping program. These mapping funds were placed in the Inventory Program budget account and used for a vegetation mapping project at GRTE. For this project, Steve Haynes and his crew at GRTE are taking vegetation samples, NatureServe is performing vegetation classification and the Bureau of Reclamation (BOR) is doing the mapping. Moreover, the Network received \$71,000 for water quality monitoring. Of this funding, \$330,234 went towards personnel costs, \$316,562 toward cooperative agreements (including conceptual modeling efforts and numerous inventory projects) and \$169,080 to contracts. Two inventory projects scheduled to take place in FY04 were prefunded using monitoring funds for a total of \$73,108.31. The Network will replace these monitoring funds in FY04.

Table 4. Summary of FY03 expenses

<i>Category</i>	<i>SubTotal</i>	<i>Percent</i>
Personnel	\$330,234	34.11%
Coop. Agreements	\$316,562	32.70%
Contracts	\$169,080	17.46%
Operations/Equipment	\$60,739	6.27%
Travel	\$40,031	4.13%
Other	<u>\$51,523</u>	5.32%
<i>Total</i>	\$968,170	

While the Network originally programmed \$50,000 towards travel, only \$40,031 was spent on travel, including the relocation of two new employees and a large workshop in Bozeman with many non-resident guests. The Network overspent funds in the inventory program and under spent funds in the monitoring program for a total of \$3,593.96 over spent funds, or 0.37% of total funds.

For FY 04 the GRYN expects to receive \$148,000 in inventory funds, \$71,000 for water quality and \$724,670 for monitoring. This will be the final year the Network receives inventory funds. The Network plans to complete the GRTE exotic plant inventory, conduct surveys on Yellowstone cutthroat trout and continue to fund the alpine vascular plant inventory at YELL using inventory dollars. Water quality funding will go toward the half-time salary of a hydrologist based at GRTE and to the development of protocols for monitoring river macroinvertebrates. Half of FY 04 monitoring dollars will go toward funding the salaries of the Program Manager, Data Manager, Ecologist, Cartographic Technician and partial support for administrative assistance through the Intermountain Support Office. The rest of these funds will go towards projects identified as critical towards the competition of phase III of the vital signs monitoring plan and data management activities.

Appendix 1. Summary of Major Accomplishments

The Greater Yellowstone Inventory and Monitoring Network (GRYN) consists of four park units located within and around the Greater Yellowstone Ecosystem, which includes parts of Idaho, Montana and Wyoming. These units include: Bighorn Canyon National Recreation Area (BICA), John D. Rockefeller, Jr. Memorial Parkway (JODR), Grand Teton National Park (GRTE) and Yellowstone National Park (YELL). For the purposes of this report, the John D. Rockefeller, Jr. Memorial Parkway is considered part of Grand Teton National Park.

The Greater Yellowstone Network was successful in accomplishing many important aspects of its inventory and monitoring programs during FY 03. For instance, cooperators helped to complete many multi-year inventories with exciting results. The vital signs monitoring program selected its vital signs through an integrative and scientifically respected process and completed—on schedule—its Vital Signs Monitoring Plan Phase II Report. The water quality monitoring program has synthesized information in preparation for creating monitoring objectives and completing the Water Quality Monitoring Phase II Report in early FY 04. Summaries of major accomplishments and highlights are included in the following sections.

INVENTORY ACCOMPLISHMENTS

Biological inventory activities within the GRYN for fiscal year (FY) 03 included the following: non-native vascular plants in YELL and GRTE; amphibians at YELL and GRTE; alpine vascular plants at YELL; alpine lakes fish, Snake River and Yellowstone cutthroat trout and sage grouse at GRTE; bats at all Network parks; and mammals at BICA. Non-native vascular plant crews in GRTE identified new invasions of tamarisk and three species of ornamentals during the 2003 survey. Inventory data is being used to create eradication and containment plans for exotic species found. In addition, this was the third year of the exotic plant inventory project at YELL. They have established a new method, called the “targeted transect method,” which has identified twenty-six of the sixty-two exotic species on the YELL priority list. The YELL alpine plant inventory, although weakened by the drought conditions, was successful in collecting 241 species, including two species not previously reported and one species verified as occurring within park boundaries (according to preliminary examination).

Amphibian inventory crews were successful in finding boreal chorus frog, tiger salamander, Columbia spotted frog and boreal toad breeding sites during their survey. Past recommendations to GRTE for protecting breeding site areas within the Snake River quarry restoration area were successful in keeping breeding populations present at the sites despite extensive landscape alteration. In addition, eleven alpine lakes were surveyed for fish species in GRTE in 2003. Yellowstone cutthroat trout were found at Grizzly Bear Lake, although no previous record exists of stocking at the lake. An inventory to systematically sample and document the geographic distribution of Snake River and Yellowstone cutthroat trout took place at GRTE and other federal lands in the Upper Snake River watershed. Although funded by numerous sources other than the Network in FY 03, reports and data will be made available to the Network.

GRTE personnel conducted a helicopter survey to identify existing and new sage grouse leks. One new lek was observed, with six male grouse strutting at the site. In addition, using mist-net

captures, staff of the Wyoming Natural Diversity Database documented most bat fauna predicted to occur within the Network and two species previously undocumented in BICA. Personnel also surveyed twelve locations for undocumented mammals and added the white-footed mouse (*Peromyscus leucopus*) to the formally documented list.

In addition to biological inventories, the GRYN also launched a new website containing background information about the GRYN, park maps, inventory and monitoring reports and presentations, information on the Delphi survey and conceptual modeling process, along with contact information for Network staff and committees. The Network made progress in compiling inventories of available remotely sensed imagery. This imagery includes twenty-five aerial photographs and thirty LANDSAT images (including five cloud-free images taken at the same time of year). Furthermore, the compilation of mining and exploration data within twenty miles of the park was completed.

Inventory Highlights

Identification of new species and locations of species of concern

- Two new alpine vascular plant species were recorded in YELL.
- Two new bat species were recorded in BICA.
- One new sage grouse lek was found in GRTE (sage grouse are a species of concern in the GRYN).

New techniques tested

- The “targeted transect method” was tested and found to be a successful method of inventorying exotic plant species in YELL.
- The use of a new technique to predict possible wetland sites through mapping led to the identification of six new amphibian breeding sites.
- Amphibian surveyors tested their probability of detecting selected species in a single visit in order to better plan future monitoring designs and sampling schemes.

Collaborations

- Researchers investigating the occurrence of exotic plant species in YELL collaborated with the Forest Service to train personnel in a new technique for weed surveys.
- The survey of the geographic distribution of the Snake River and Yellowstone cutthroat trout was a highly collaborative effort, with eight agencies and organizations participating.
- Amphibian investigators worked with both the Aquatic Resources Division of the Yellowstone Center for Resources and the U.S. Fish and Wildlife Service to monitor amphibian occurrence and disease frequency and create management strategies.
- The Network collaborated with other I&M networks to hire a technician to catalog herbarium specimens at the University of South Dakota that were collected in Network parks.

Leveraged funds

- Steve Haynes, GRTE vegetation management specialist, volunteered his time and expertise to lead the exotic vascular plant survey in GRTE during FY 03.
- Sue Wolff, GRTE wildlife biologist, volunteered her time and expertise to lead the sage grouse inventory in GRTE during FY03.

- Jennifer Whipple, YELL botanist, donated her time to lead a field crew on alpine plant surveys.
- The survey of the geographic distribution of the Snake River and Yellowstone cutthroat trout was funded entirely by non-Network monies; yet, the Network, through its relationship with GRTE, will have access to the final reports and data.
- Maintenance staff from BICA and YELL helped install the Remote Automated Weather Station (RAWS) northwest of Barry's Landing in BICA.
- The on going I&M exotic inventory projects taking place in BICA and YELL have benefited from inventories taking place by the Intermountain Region Weed Mapping project and the Exotic Plant Management Team.
- The Air Resource Division funded an Air Resource Inventory project that will benefit the Vital Signs program in the GRYN
- The Water Resource Division contributed towards the lake classification project at GRTE that will benefit the GRYN.
- The USGS Amphibian Research Monitoring Initiative (ARMI) helped fund the Amphibian Inventory that took place at GRTE and YELL.

Education and dissemination of information

- Bat inventory personnel completed a GIS-based habitat model to facilitate the selection of suitable bat inventory sites and initiated the development of a bat call library to facilitate future acoustic monitoring efforts.
- Bat investigators aided the Teton Science School in developing a student-run bat project and mist-net demonstration.
- Five presentations about inventory activities in the GRYN will be presented at scientific meetings in FY 04.
- Numerous peer-reviewed journal articles and final reports are expected from these inventories.

MONITORING ACCOMPLISHMENTS

The GRYN created a plan for designing conceptual ecological models that describe the interactions among the key components of terrestrial, aquatic and geothermal systems within the Network. With the help of numerous experts who have vast knowledge of these systems, the conceptual models identified many potential vital signs. Simultaneously, the results from the third and final iteration of the internet-based Delphi survey were received, having been completed in conjunction with the University of Idaho-College of Natural Resources. Meanwhile, the GRYN held park-specific workshops in order to gain insight into the strengths and weaknesses of the potential vital signs, the conceptual modeling process and the selection criteria. These workshops were created to gain park input into the vital signs selection process, as well as acquire peer review on the proposed set of selection criteria questions to be used to select vital signs. The information obtained was essential to the success of the criteria during the Vital Signs Monitoring Workshop, held in Bozeman, Montana in May 2003.

At the workshop, almost sixty subject-area experts were invited to share their expertise by ranking all potential vital signs (from both the conceptual modeling and Delphi processes) using the selection criteria. By all accounts, the workshop was a success and allowed for input from

experts from other government agencies, academia and the non-profit and private sectors. Using this wealth of information, the GRYN hosted a Technical Committee meeting in which members used the ranked results of the expert workshop, added their management expertise, and created a proposed final list of vital signs for approval by the Board of Directors (BOD). This list was approved in August 2003 by the BOD. The Science Committee peer reviewed the selected vital signs and praised the comprehensive nature of the list. The Science Committee applauded the use of conceptual models during the process and recommended the continued use of models to explain the interconnectedness of the vital signs.

The completion of the Phase II Report was an essential component in the accomplishments of FY 03. Phase II included editing versions of chapters one (background information and legal mandates) and two (conceptual modeling) from Phase I, along with chapter three (vital signs selection process). The Phase II Report received peer review from both the Science and Technical Committees before it was given to the Intermountain Support Office and National I&M Program Manager.

Furthermore, the Network has completed hiring its permanent, full-time staff. These hires included the addition of Dr. Robert Bennetts, formerly of the USGS, as the GRYN Ecologist and Robert Daley, formerly of the Forest Service, as the Network Data Manager.

Monitoring Highlights

Vital signs selection process

- The creation of an MSAccess Decision Support System database allowed the Network to quickly compare, in an unbiased manner, all of the input from subject-area experts attending the Vital Signs Monitoring Workshop.
- The selection of vital signs for monitoring long-term ecological health in the Network was an enormous accomplishment, which also fulfills the Government Performance and Results Act (GPRA) Goal 1b3: Vital Signs Identification.
- The use of conceptual models not only helped to identify potential vital signs, as reported in chapter two of the Phase II Report. They were also useful in showing the integration of the vital signs selected and will continue to be important to the Network during the monitoring design process.

Collaboration

- The GRYN created five task agreements to undertake synoptic reviews of existing data and/or compilation and analyses of such data.

Outreach

- The GRYN hosted two park-specific workshops during FY 03 to gain input and peer review on the vital signs selection process from park managers.
- The Network hosted an Exotic Weed Workshop to enhance the communication, cooperation and coordination among NPS, academia and other government agencies working on exotic plant surveys and management.

Miscellaneous

- A literature review containing over 350 papers was completed for the Network.
- A report was prepared that summarized the paleontological resources of BICA, GRTE and YELL, including specific information on resources found, as well as a synopsis of relevant literature and datasets available to the Network.
- A Remote Automated Weather Station (RAWS) was installed in BICA; this is the first weather station within park boundaries.

WATER QUALITY MONITORING ACCOMPLISHMENTS

The GRYN prepared a separate Phase II Report for the water quality monitoring portion of the program. This Phase II Water Quality Report is scheduled for completion early in FY 04. During FY 03, the core water quality group focused on several topics, including: 1) the development of and solicitation of requests for proposals for projects such as protocol development, synoptic studies, technical assistance requests for study plans, statistical frameworks/designs; 2) summarizing management issues and stressors related to water quality; 3) summarizing current water quality monitoring efforts; 4) a review of available field protocols for National Park Service-Water Resources Division (NPS-WRD) “core parameters”; and 5) the development of monitoring objectives for impaired, or 303(d) listed, waters within Network parks.

Water Quality Highlights

- Past water quality data were analyzed, areas exceeding state water quality standards identified and monitoring objectives for streams with impaired water quality were developed.
- Surface water classification project and GIS themes developed for vital signs monitoring.
- A collaborative synoptic review of water quality issues concerning Soda Butte Creek was started.

Budget Summary

FY03 Admin Report

Network: 10 Greater Yellowstone

Category: 1_Income

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Vital Signs Monitoring	\$724,670.00	I&M - VS Monitoring	VS	Memo (3/25/2003) AD NRSS
Inventory Program	\$136,500.00	I&M - Biol. Inventory	VS	Memo (3/13/2003)
Water Quality Monitoring Program	\$71,000.00	WRD - WQ Monitoring	VS	WRD Transfer memo (3/31/2003) # 03-02
Grand Teton Vegetation Map	\$36,000.00	Veg. Mapping Program	VS	Per Mike Britten
Subtotal	\$968,170.00			

Category: 2_Personnel

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Susan O'Ney (staff)	\$27,248.23	I&M - VS Monitoring	NPS	.5 FTE Hydrologist
U.of South Dakota Herbarium project	\$1,060.14	I&M - VS Monitoring	NPS	Non-permanent biological technician
Surface Water Classification	\$11,028.98	WRD - WQ Monitoring	NPS	Non-permanent cartographic technicians @ YELL and GRTE
Paleo Resource Review	\$3,577.84	I&M - VS Monitoring	NPS	Non-permanent technician - Allison Koch
Non-native Vascular Plant Inventory (GRTE)	\$22,512.31	I&M - Biol. Inventory	NPS	Non-permanent technicians supervised by Steve Haynes
Exotic Plant Workshop	\$1,262.53	I&M - VS Monitoring	NPS	Non-permanent technician (YELL) organized agenda and participant list
Data Management Support Activities	\$11,118.18	I&M - VS Monitoring	NPS	Non-permanent cartographic technicians supervised by Ann
Data gathering (mining & exploration)	\$3,922.52	I&M - Biol. Inventory	NPS	Non-permanent cartographic technicians supervised by Ann
Computer Administration	\$6,533.08	I&M - VS Monitoring	NPS	Non-permanent technician - Steve Miller YELL
Administrative Support	\$16,400.98	I&M - VS Monitoring	NPS	Budget, procurement & contracting (YELL) - Colleen Watson
Water Quality Planning	\$6,564.38	I&M - VS Monitoring	NPS	Non-permanent staff at YELL
Susan O'Ney (staff)	\$3,316.74	WRD - WQ Monitoring	NPS	.5 FTE Hydrologist
Alpine Plant Inventory	\$3,046.35	I&M - Biol. Inventory	NPS	Non-permanent staff (YELL) supervised by Jennifer Whipple
Robert Bennetts (staff)	\$8,500.30	I&M - VS Monitoring	NPS	Ecologist
Rob Daley (staff)	\$2,108.48	I&M - VS Monitoring	NPS	Data Manager

Laura Gianakos (staff)	\$51,116.17	I&M - VS Monitoring	\$	NPS	Term Ecologist
Glenn Plumb (staff)	\$30,880.14	I&M - VS Monitoring	\$	NPS	Ecologist (120 day detail)
Chad Jacobson (staff)	\$44,828.47	I&M - VS Monitoring	\$	NPS	Cartographic Technician
Cathie Jean (staff)	\$69,535.10	I&M - VS Monitoring	\$	NPS	Program Manager
Administrative Support	\$5,527.52	I&M - Biol. Inventory	\$	NPS	GRTE Admin support
Vital Signs Planning	\$145.78	I&M - VS Monitoring	\$	NPS	Non-permanent staff - Cheryl Jaworowski (geothermal conceptual model)

Subtotal \$330,234.22

Category: 3_Coop. Agreements

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Non-native Vascular Plant Inventory FY04 (YELL)	\$41,108.31	I&M - Biol. Inventory	University-CESU	Montana State University
Amphibian Monitoring (FY04)	\$42,988.44	I&M - VS Monitoring	Univ_Non-CESU	Idaho State University (implementation subject to peer
Conceptual Models- Vital Signs Phase Monitoring	\$24,975.00	I&M - VS Monitoring	University-CESU	Montana State University (Duncan Patten)
Amphibian Inventory I (GRTE and YELL) (FY03)	\$11,000.00	I&M - Biol. Inventory	University-CESU	Idaho State University
Amphibian Inventory I (GRTE and YELL) (FY03)	\$500.00	I&M - VS Monitoring	University-CESU	Idaho State University
Amphibian synoptic review & protocol design	\$13,540.08	I&M - VS Monitoring	Univ_Non-CESU	Idaho State University
Bat Inventory (FY03)	\$20,000.00	I&M - Biol. Inventory	University-CESU	University of Wyoming
Bat Inventory (FY04)	\$32,000.00	I&M - VS Monitoring	University-CESU	University of Wyoming (prefunded in FY03 with Vital Signs funds)
Non-native Vascular Plant Inventory FY03 (YELL)	\$41,000.00	I&M - VS Monitoring	University-CESU	Montana State University
Network & CESU support	\$6,000.00	I&M - VS Monitoring	University-CESU	University of Montana
River Macroinvertebrate Protocol	\$10,000.00	I&M - VS Monitoring	University-CESU	Utah State University
Small Mammal Inventory	\$19,000.00	I&M - Biol. Inventory	University-CESU	University of Wyoming
Synoptic study Soda Butte	\$24,760.00	WRD - WQ Monitoring	University-CESU	University of Colorado
Whitebark Pine data analysis	\$9,775.00	I&M - VS Monitoring	University-CESU	Montana State University
Conceptual Models- Vital Signs Phase Monitoring	\$19,915.00	I&M - VS Monitoring	University-CESU	University of Wyoming (Bob Hall & Dan Tinker)

Subtotal \$316,561.83

Category: 4_Contracts

<i>Description</i>	<i>\$ Amount</i>	<i>\$\$ Source</i>	<i>Where \$ Went</i>	<i>Comments</i>
Writer/editor Phase II Vital Signs Plan	\$27,000.00	I&M - VS Monitoring	Other non-Federal	Contract with writer Scott Bischke
Sage Grouse Survey	\$3,000.00	I&M - Biol. Inventory	Other non-Federal	Helicopter air time
Climate Data Analysis	\$5,280.00	I&M - VS Monitoring	Other non-Federal	Dave Selkowitz
Collect & analyze air quality and deposition data	\$20,000.00	I&M - VS Monitoring	USGS	IG with WRD - Colorado District

Water Quality Planning	\$1,200.00	I&M - VS Monitoring \$\$	Other non-Federal	Edit Phase II Water Quality Plan
GRTE Vegetation Map	\$36,000.00	Veg. Mapping Program	Other Federal	IG with Bureau of Reclamation
Office Facilities at Forestry Science Lab	\$13,800.00	I&M - VS Monitoring \$\$	USGS	IG with Northern Rockies Science Center
Aquatic ecosystem risk assessment	\$25,000.00	WRD - WQ Monitoring	USGS	IG with WRD - Colorado District
Vital Signs Workshop Facilitation	\$22,000.00	I&M - VS Monitoring \$\$	Other non-Federal	Contract with facilitator Michele Tae
Seeps & Springs (BICA)	\$5,500.00	WRD - WQ Monitoring	USGS	IG with WRD - Wyoming District
Seeps & Springs (BICA)	\$10,300.00	I&M - VS Monitoring \$\$	USGS	IG with WRD - Wyoming District
Subtotal	\$169,080.00			

Category: 5_Operations/Equipment

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Vital Signs Workshop	\$455.41	I&M - VS Monitoring \$\$	Other non-Federal	Conference Facilities
Field Operations	\$1,770.00	I&M - VS Monitoring \$\$	NPS	Radio batteries
Non-native Vascular Plant Inventory (GRTE)	\$7,065.00	I&M - Biol. Inventory \$\$	Other non-Federal	GPS unit for GRTE
Equipment Rental	\$4,500.00	I&M - Biol. Inventory \$\$	Other non-Federal	Xerox rental (instead of facility)
Water Quality Planning	\$2,902.86	I&M - VS Monitoring \$\$	Other non-Federal	Radio replacement
Field Operations	\$775.00	I&M - Biol. Inventory \$\$	Other non-Federal	Housing (trailer rental)
Science support from parks	\$6,289.78	I&M - VS Monitoring \$\$	Other non-Federal	Operational expenses
Office Operations	\$187.50	I&M - VS Monitoring \$\$	USGS	Office Books
Alpine Plant Inventory	\$729.37	I&M - Biol. Inventory \$\$	Other non-Federal	Equipment for horse packing stock
Moving expenses	\$17,758.61	I&M - VS Monitoring \$\$	Other non-Federal	Relocate Rob Daley and Rob
GIS data development	\$660.00	I&M - VS Monitoring \$\$	Other non-Federal	SID software
Vital Signs Planning	\$316.50	I&M - VS Monitoring \$\$	Other non-Federal	Office Books
Vital Signs Planning	\$51.14	I&M - VS Monitoring \$\$	Other Federal	Office Books
Technical Committee Business	\$136.35	I&M - VS Monitoring \$\$	Other non-Federal	Zanterra meeting facilities
Science Committee Meeting	\$225.00	I&M - VS Monitoring \$\$	Other non-Federal	Meeting facilities
Office Operations	\$119.55	I&M - VS Monitoring \$\$	Other Federal	Office Books
GIS data development	\$4,994.66	I&M - VS Monitoring \$\$	NPS	Computer replacement
Field Operations	\$343.76	I&M - VS Monitoring \$\$	Other non-Federal	GPS antenna replacement
Field Operations	\$1,415.00	I&M - Biol. Inventory \$\$	Other non-Federal	Housing (trailer rental)
Data Management Support Activities	\$1,208.39	I&M - VS Monitoring \$\$	Other non-Federal	Computer/software
Office Operations	\$8,835.22	I&M - VS Monitoring \$\$	Other non-Federal	Phone, office supplies & computer hardware/software
Subtotal	\$60,739.10			

Category: 6_Travel

<i>Description</i>	<i>\$ Amount</i>	<i>\$\$ Source</i>	<i>Where \$ Went</i>	<i>Comments</i>
Site visit, training or meeting	\$20,805.30	I&M - VS Monitoring \$\$	Other non-Federal	Staff network business
Surface Water Classification	\$488.52	WRD - WQ Monitoring	Other non-Federal	Meeting at GRTE
Technical Committee Business	\$3,021.90	I&M - VS Monitoring \$\$	Other non-Federal	Attend network TC meetings
Site visit, training or meeting	\$804.46	WRD - WQ Monitoring	Other non-Federal	Staff network business
Science Committee Meeting	\$1,573.29	I&M - VS Monitoring \$\$	Other non-Federal	Staff network business
Moving expenses	\$5,683.36	I&M - VS Monitoring \$\$	Other non-Federal	Relocate Rob Daley and Rob
Exotic Plant Workshop	\$1,567.16	I&M - VS Monitoring \$\$	Other non-Federal	Invited participants
Vital Signs Workshop	\$4,918.33	I&M - VS Monitoring \$\$	Other non-Federal	Invited subject area experts
Alpine Plant Inventory	\$1,020.00	I&M - Biol. Inventory \$\$	Other non-Federal	Reimburse inventory crew at backcountry rates
Surface Water Classification	\$149.00	I&M - VS Monitoring \$\$	Other non-Federal	Meeting at GRTE
Subtotal	\$40,031.32			

Category: 7_Other

<i>Description</i>	<i>\$ Amount</i>	<i>\$\$ Source</i>	<i>Where \$ Went</i>	<i>Comments</i>
Moving expenses	\$51,655.36	I&M - VS Monitoring \$\$	Other non-Federal	Relocate Rob Daley and Rob
Boundary Stressor (mining & exploration)	\$476.53	I&M - VS Monitoring \$\$	NPS	Reimburse volunteers
Data Management Support Activities	\$1,000.00	I&M - VS Monitoring \$\$	NPS	Conference registration
Unspent Monitoring Funds	\$4,426.00	I&M - VS Monitoring \$\$		Unspent Monitoring funds
Office Operations	\$1,730.60	I&M - VS Monitoring \$\$	Other Federal	Reimburse Sawtooth NF for Daley salary
Overspent Inventory Funds	(\$8,121.00)	I&M - Biol. Inventory \$\$		Overspent Inventory Funds
Unspent Water Funds	\$101.00	WRD - WQ Monitoring		Unspent water funds
Field Operations	\$255.00	I&M - VS Monitoring \$\$	Other non-Federal	Housing (trailer rental)
Subtotal	\$51,523.49			

Budget Analysis

Analysis of Expenses by Where \$ Went

<i>Funding Source</i>	<i>Total \$\$</i>	<i>NPS</i>	<i>USGS</i>	<i>Other Federal</i>	<i>Univ.-CESU</i>	<i>Univ_Non-CESU</i>	<i>Other non-Federal</i>
I&M - Biol. Inventory	\$136,500	\$35,009			\$91,108		\$18,504
I&M - VS Monitoring \$\$	\$724,670	\$289,121	\$44,288	\$1,901	\$144,165	\$56,529	\$184,241
Veg. Mapping Program	\$36,000			\$36,000			
WRD - WQ Monitoring	\$71,000	\$14,346	\$30,500		\$24,760		\$1,293
Totals	\$968,170	\$338,475	\$74,788	\$37,901	\$260,033	\$56,529	\$204,038

Analysis of Expenses by Category

<i>Funding Source</i>	<i>Total \$\$</i>	<i>Personnel</i>	<i>Coop Agree.</i>	<i>Contracts</i>	<i>Operations/Equip</i>	<i>Travel</i>	<i>Other</i>
I&M - Biol. Inventory	\$136,500	\$35,009	\$91,108	\$3,000	\$14,484	\$1,020	(\$8,121)
I&M - VS Monitoring \$\$	\$724,670	\$280,880	\$200,694	\$99,580	\$46,255	\$37,718	\$59,543
Veg. Mapping Program	\$36,000			\$36,000			
WRD - WQ Monitoring	\$71,000	\$14,346	\$24,760	\$30,500		\$1,293	\$101
Totals	\$968,170	\$330,234	\$316,562	\$169,080	\$60,739	\$40,031	\$51,523

Expense Totals By Category

<i>Category</i>	<i>SubTotal</i>	<i>Percent</i>
2_Personnel	\$330,234	34.11%
3_Coop. Agreements	\$316,562	32.70%
4_Contracts	\$169,080	17.46%
5_Operations/Equipment	\$60,739	6.27%
6_Travel	\$40,031	4.13%
7_Other	\$51,523	5.32%
	\$968,170	

Budget Summary

FY04 Work Plan

Network: 10 Greater Yellowstone

Category: 1_Income

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Inventory Program	\$148,000.00	I&M - Biol. Inventory \$\$	NPS	
Water Quality Monitoring	\$71,000.00	WRD - WQ Monitoring	NPS	
Vital Signs Monitoring	\$724,670.00	I&M - VS Monitoring \$\$	NPS	
Subtotal	\$943,670.00			

Category: 2_Personnel

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Robert Bennetts - Ecologist	\$78,690.94	I&M - VS Monitoring \$\$	NPS	Staff
BICA Resource Management Specialist (TERM 5 pp)	\$10,000.00	I&M - VS Monitoring \$\$	NPS	Planning and park contact on I&M inventory projects at BICA
GRTE Non-Native Plant Inventory	\$36,000.00	I&M - Biol. Inventory \$\$	NPS	Non-permanent staff supervised by Steve Haynes
Admin Assistant	\$24,000.00	I&M - VS Monitoring \$\$	NPS	(\$\$est.) GS-7 Term Assistant (ISO)
Cathie Jean - Program Manager	\$85,751.40	I&M - VS Monitoring \$\$	NPS	Staff
Susan O'Ney - Hydrologist (.5 FTE)	\$42,000.00	WRD - WQ Monitoring	NPS	Staff
Chad Jacobson - Data Technician	\$44,717.51	I&M - VS Monitoring \$\$	NPS	Staff
Jeff Arnold (YELL TERM 4 pp)	\$10,000.00	WRD - WQ Monitoring	NPS	(\$\$ est.) Assist with protocols and test QC/QA and data management SOP's
Cartographic and data support	\$7,450.00	I&M - VS Monitoring \$\$	NPS	1 GS/7 4 pay period. Hydro-geo Model (technicians supervised by Staff)
Robert Daley - Data Manager	\$84,201.60	I&M - VS Monitoring \$\$	NPS	
Leslie Frattaroli (GRTE TERM 1 pp)	\$2,500.00	I&M - Biol. Inventory \$\$	NPS	(\$\$ est.) Non-permanent GRTE: to compile non-native vascular plant data at GRTE for network report
Subtotal	\$425,311.45			

Category: 3_Coop. Agreements

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Big Sky Program Coordinator	\$11,948.00	I&M - VS Monitoring \$\$	University-CESU	Year end funds to Big Sky Institute (employee salary & benefits)
Climate/weather monitoring protocol	\$20,000.00	I&M - Biol. Inventory \$\$	University-CESU	(\$\$ est.) Climate monitoring protocol development and workshop costs.
Peer review and subject experts	\$15,000.00	I&M - VS Monitoring \$\$	University-CESU	(\$\$ est.) Peer review and/or expertise from academic and USGS subject experts
Land use monitoring protocol	\$49,983.00	I&M - VS Monitoring \$\$	University-CESU	Andy Hansen, Montana State
Exotic plant monitoring protocol	\$10,000.00	I&M - VS Monitoring \$\$	University-CESU	(\$\$ est.) Contribute funds towards regional proto-type invasive plant monitoring plan
Statistical support	\$20,000.00	I&M - VS Monitoring \$\$	University-CESU	Montana State University- Math & Statistics department
Climate/weather monitoring protocol	\$20,000.00	I&M - VS Monitoring \$\$	University-CESU	(\$\$ est.) Climate monitoring protocol development and workshop costs.
River macroinvertebrate monitoring protocol	\$6,000.00	I&M - VS Monitoring \$\$	University-CESU	Dr. Chuck Hawkins USU (1 of 2)
Water Quality subject experts	\$40,000.00	I&M - VS Monitoring \$\$	University-CESU	Water chemistry monitoring protocol development and workshop costs
River macroinvertebrate monitoring protocol	\$19,000.00	WRD - WQ Monitoring	University-CESU	(\$\$ est.) Dr. Chuck Hawkins USU (2 of 2)
NPSpecies - botany student	\$5,000.00	I&M - VS Monitoring \$\$	University-CESU	(\$\$ est.) MSU or UW botany
Yellowstone Cutthroat Trout Inventory	\$57,500.00	I&M - Biol. Inventory \$\$	University-CESU	Upper Snake River Inventory, Dr. Robert Gresswell, Mark Novak
Project Coordinator (vegetation ecologist)	\$40,000.00	I&M - VS Monitoring \$\$	University-CESU	(\$\$ est.) Big Sky Institute (employee salary & benefits)
Subtotal	\$314,431.00			

Category: 4_Contracts

Description	\$ Amount	\$\$ Source	Where \$ Went	Comments
Writer / Editor / Facilitator	\$30,000.00	I&M - VS Monitoring \$\$	Other non-Federal	per contract rates
Spring & seep monitoring protocol	\$40,000.00	I&M - VS Monitoring \$\$	USGS	(\$\$ est.) Mike Sweat, WRD Cheyenne Office
Landbird and amphibian monitoring protocol	\$25,000.00	I&M - Biol. Inventory \$\$	USGS	(\$\$ est.) USGS Patuxent Wildlife Research Center
Subtotal	\$95,000.00			

Category: 5_Operations/Equipme

<i>Description</i>	<i>\$ Amount</i>	<i>\$\$ Source</i>	<i>Where \$ Went</i>	<i>Comments</i>
GRTE GSA vehicle rental	\$1,830.00	I&M - VS Monitoring \$\$	Other Federal	6 months at 205.00 plus .14 a mile (est. 100.00 per month)
Office equipment and supplies	\$25,000.00	I&M - VS Monitoring \$\$	Other non-Federal	(\$\$ est.) Supply network
Cellular phone service	\$840.00	I&M - VS Monitoring \$\$	Other non-Federal	(\$\$ est.) Annual cost for 2 phones
Vehicle	\$1,000.00	I&M - VS Monitoring \$\$	Other non-Federal	Ford Expedition maintenance costs
Cooperator Housing	\$2,000.00	I&M - Biol. Inventory \$\$	Other non-Federal	(\$\$ est.) Housing for field crews
Training tuition and fees	\$5,000.00	I&M - VS Monitoring \$\$	Other non-Federal	(\$\$ est.) Supervision, GIS and NPS database
Facilities at FSL and AJM	\$30,757.55	I&M - VS Monitoring \$\$	USGS	Includes FS and USGS overhead
Subtotal	\$66,427.55			

Category: 6_Travel

<i>Description</i>	<i>\$ Amount</i>	<i>\$\$ Source</i>	<i>Where \$ Went</i>	<i>Comments</i>
Network travel	\$30,000.00	I&M - VS Monitoring \$\$	Other non-Federal	Reduced by 25% from FY03
Subtotal	\$30,000.00			

Category: 7_Other

<i>Description</i>	<i>\$ Amount</i>	<i>\$\$ Source</i>	<i>Where \$ Went</i>	<i>Comments</i>
Alpine Vascular Plant Inventory	\$5,000.00	I&M - Biol. Inventory \$\$	NPS	Supervised by Mary Hetkner at
Science Committee Meeting & Honorarium	\$7,500.00	I&M - VS Monitoring \$\$	Other non-Federal	(\$\$ est.) 2 meetings total (1 in FY03 and 1 in FY04)
Subtotal	\$12,500.00			

Budget Analysis

Analysis of Expenses by Where \$ Went

<i>Funding Source</i>	<i>Total \$\$</i>	<i>NPS</i>	<i>USGS</i>	<i>Other Federal</i>	<i>Univ.-CESU</i>	<i>Univ_Non-CESU</i>	<i>Other non-Federal</i>
I&M - Biol. Inventory	\$148,000	\$43,500	\$25,000		\$77,500		\$2,000
I&M - VS Monitoring \$\$	\$724,670	\$334,811	\$70,758	\$1,830	\$217,931		\$99,340
WRD - WQ Monitoring	\$71,000	\$52,000			\$19,000		
Totals	\$943,670	\$430,311	\$95,758	\$1,830	\$314,431		\$101,340

Analysis of Expenses by Category

<i>Funding Source</i>	<i>Total \$\$</i>	<i>Personnel</i>	<i>Coop Agree.</i>	<i>Contracts</i>	<i>Operations/Equip</i>	<i>Travel</i>	<i>Other</i>
I&M - Biol. Inventory	\$148,000	\$38,500	\$77,500	\$25,000	\$2,000		\$5,000
I&M - VS Monitoring \$\$	\$724,670	\$334,811	\$217,931	\$70,000	\$64,428	\$30,000	\$7,500
WRD - WQ Monitoring	\$71,000	\$52,000	\$19,000				
Totals	\$943,670	\$425,311	\$314,431	\$95,000	\$66,428	\$30,000	\$12,500

Expense Totals By Category

<i>Category</i>	<i>SubTotal</i>	<i>Percent</i>
2_Personnel	\$425,311	45.07%
3_Coop. Agreements	\$314,431	33.32%
4_Contracts	\$95,000	10.07%
5_Operations/Equipment	\$66,428	7.04%
6_Travel	\$30,000	3.18%
7_Other	\$12,500	1.32%
	\$943,670	

Mini-Portal: Vital Signs Planning FY 2004 Greater Yellowstone Network

WHITEBARK PINE

Our objective for this year is to complete a monitoring plan for Whitebark Pine in the Greater Yellowstone. A vegetation ecologist, hired through Big Sky Institute will serve as network point-of-contact and be responsible for compiling the monitoring plan and protocols. We plan to coordinate closely with the Greater Yellowstone Coordinating Committee (GYCC) and the Interagency Grizzly Bear Study Team (IGBST) who are also in the business of monitoring whitebark pine. In support of this, the network is currently compiling information on threats and issues related to whitebark pine ecosystems and cited in scientific literature. Steve Cherry (MSU) is working with the group to conduct preliminary statistical analyses on data previously collected by Kate Kendall (YELL) and Dan Tyers (Gallatin) to facilitate the use of such data in determining the monitoring objectives and design. Lisa Landenberg (NRMSC) is working on the GYA wide map of whitebark pine. Rob B. has met with Steve Cherry to discuss the objectives, preliminary analyses, and some potential design issues. He has also communicated with Chuck Schwartz of the USGS Grizzly Project, and Kate Kendall (also with USGS) regarding the potential objectives of a monitoring program. Based on a proposal submitted by Chuck Schwartz and Dan Reinhart, money under the auspices of “Forest Health” has been targeted to initiate a project during FY04 to determine the status and condition of Whitebark Pine in the GYE. On 6 January, Rob participated in the first of what is likely to be several meetings intended to develop specific objectives both for a pilot effort using the “Forest Health” money, and the longer term effort cooperatively with the GRYN. In an upcoming trip to Fort Collins, Rob is planning to meet with Dr. Diana Tomback (University of Colorado at Denver), who is director of the Whitebark Pine Ecosystem Foundation, and long-time researcher of Whitebark pine communities. The Whitebark Pine Ecosystem Foundation will be presenting a field methods workshop in June. The GRYN will participate in that workshop and incorporate or work to modify standard field protocols that are consistent with the objectives of our program. The GRYN protocol narrative and standard operating plans will be contributed by staff and compiled and published by writer/editor.

EXOTIC PLANT

Our objective for this year is to *compile and analyze available and relevant exotic plant data sets in a final inventory report to facilitate the development of monitoring objectives and design*. We anticipate that in FY05, the final review draft of an exotic plant monitoring plan will be complete. *A new position titled project coordinator will be filled through Big Sky Institute to assist the network on terrestrial vegetation subjects*. The project coordinator will synthesize specific issues and threats relating to exotic plants, host workshops and oversee the development of monitoring objectives. Currently we

will be coordinating with proto-type and regional programs to collaborate on invasive plant monitoring protocols.

LAND BIRDS

Our objective for this year is to complete a monitoring plan for Land birds in the Greater Yellowstone Network. Rob Bennetts will lead the development on the land bird monitoring plan that will be closely integrated with the communities of concern vital signs. The protocol narrative and standard operating plans will be compiled by staff and finished by writer/editor. Rob has met with Sue Wolff and Steve Cain to learn more about the management issues and threats facing landbirds in GRTE. In December, Rob B. and Cathie traveled to Missoula to discuss the Montana Land bird Monitoring Program at University Montana with Dick Hutto. They also met with Paul Hendricks, Montana Natural Heritage Program on alpine bird monitoring considerations. We are in the process of establishing communicating (i.e., initial contacts have been made, but detailed discussions are forthcoming) with several additional experts that have extensive experience monitoring birds in communities of concern (i.e., riparian, alpine, shrub steppe, and aspen). These include Dr. Kathy Martin (Univ. British Columbia and the Center for Alpine Studies) for alpine habitats, Dr. Steve Knick (USGS, Forest and Range Ecosystem Science Center) and Michael Schroeder (Washington Department of Fish and Wildlife) for shrub steppe habitats. In addition, we have reviewed the state monitoring plans for Montana (USFS Northern Region Landbird Monitoring Program, sponsored by University of Montana), Wyoming (Wyoming Bird Conservation Plan, sponsored by Wyoming Partners in Flight), and Colorado (Colorado Bird Conservation Plan, sponsored by Colorado Partners in Flight and the Colorado Bird Observatory). We have also initiated communication with USGS scientists at the Patuxent Wildlife Research Center e.g., John Sauer to resolve some design issues that have plagued several bird-monitoring programs. This spring we plan to conduct workshops with GRTE and Yellowstone Center for Resources to prepare monitoring objectives for land birds in the GRYN.

AMPHIBIANS

Our objective for this year is to complete a monitoring plan for amphibians in the Greater Yellowstone Network. In support of this, the network entered into a task agreement (in 2003) with Dr. Chuck Peterson, Department of Biological Sciences, Idaho State University. Although the agreement was initially set up for delivery of specific “products” including a subject review, data analysis and written recommendations, we have found that an interactive mode of working with these collaborators is better suited toward achieving our GRYN goals of developing monitoring objectives and designing a monitoring program that meets the needs of both the USGS Amphibian Research and Monitoring Initiative (ARMI) and the GRYN. The ARMI program has already undertaken considerable planning and effort, such that it would be counter-productive to develop a program independent of this effort. Rather, it is our intention to work with ARMI to ensure that our programs are compatible, but still meets the needs of the GRYN. Rob Bennetts and Rob Daley are actively working with Chuck and Deb Patla on issues related to data management, analysis and design (based on previous data). We have also initiated communication with USGS scientists at the Patuxent Wildlife

Research Center (e.g., Jim Nichols, John Sauer, and Larissa Bailey), who have been actively working with ARMI, and have agreed to work with us in developing objectives and, if necessary, refine existing analytical tools for meeting these objectives. Rob Bennetts will also be attending an ARMI workshop this spring on their “Proportion of Area Occupied” approach. In FY04, the network plans to conduct a pilot project to field test changes to the sampling design and field methodology. A workshop to address design and analysis issues will be planned for this spring; participants will include ARMI statisticians and software developers. At least two other networks, the Northern Colorado Plateau Network and the National Capital Network will be invited to participate in our workshop.

EXOTIC AQUATIC ASSEMBLAGES

Our objective for this year is to compile information on aquatic threats and issues cited in scientific literature *to facilitate the development of monitoring objectives and design*. Once objectives are established (early FY05), we will begin negotiating with a CESU or other partner to form task agreements needed to effectively prepare the monitoring plan for exotic aquatic assemblages. Inventories for Yellowstone Cutthroat Trout in the upper Snake River are scheduled to take place in FY04. Mark Novak (USFS) will be conducting the inventory at GRTE and YELL (perhaps under the guidance of Dr. Robert Gresswell (USGS)) will be conducting the inventory at YELL.

AQUATIC INVERTEBRATE ASSEMBLAGES

Our objective for this year is to complete a monitoring plan for aquatic invertebrates in the GRYN. Dr. Charles P. Hawkins, Professor of Aquatic Ecology and Director of the Western Center for Monitoring and Assessment of Freshwater Ecosystems is working with us to 1) prepare a report that summarizes the state of understanding of stream and river invertebrate assemblages in the GRYN and (2) a preliminary study plan for proceeding with the protocol development for Network long-term monitoring of stream and river invertebrates (due March 31, 2004). In October of this year, Rob Bennetts visited Chuck’s facility in Logan, Utah to discuss the project and our expectations. As a result, Rob was invited to attend a workshop (February 3-5 at the US EPA Laboratory facility in Corvallis, OR.) to examine the application and derivation of rigorously defined, stressor-specific tolerance values for streams and rivers of the western United States. Rob Bennetts recently met with Dr. Wayne Minshall, Stream Ecology Center, Idaho State University in December to discuss this vital sign, and has plans of meeting with Dr. William Clements of Colorado State University later this month to discuss his long-term research on the response of aquatic invertebrates to metals.

CLIMATE

Our objective for this year is to prepare a scope of work with more or more cooperators who can help the network synthesize and formulate climate monitoring objectives. Like land-use, climate objectives and protocols will have an important role that will permeate through the entire vital signs monitoring program. We expect the scope of work to be

similar to that of land-use. The cooperator will also help the network host a climate workshop to formulate objectives and devise the best way to monitor climate in the GRYN. The workshop will focus on the integration of climate/weather data as an explanatory variable in vital signs monitoring and also as a continuous record useful for climate change monitoring. One outcome of the workshop would include recommended locations for new monitoring equipment and strategies for installing and maintaining equipment. In the future, we would like to complete a report, similar to that which was completed for Cape Code National Seashore that summarizes the meteorological and atmospheric protocols in use in the GRYN.

STREAMFLOW

Streamflow is currently measured at several permanent stream-gauging stations that are operated by the USGS. A needs assessment will be done concurrently with the other vital sign planning to evaluate the status of existing permanent stream gauging stations, data gaps and information needs pertinent to the water quality and chloride flux monitoring programs. The results from the needs assessment will be included in the phase III monitoring plan. Chloride flux, a geothermal vital sign, is measured currently with streamflow. The Geothermal Monitoring Plan has recommended eight new gauging stations to help improve the resolution of chloride flux monitoring. On December 15, Cathie met with staff at the USGS-WRD Helena, Montana to learn and visit about stream gauging stations. An effort by WRD has been initiated for a review our state-of-knowledge on stream flow and we will certainly incorporate the findings of this effort in our planning.

ARID LAND SEEP AND SPRINGS

Our objective for this year is to complete a monitoring plan for arid land seeps and springs in Bighorn Canyon NRA. We are presently negotiating a scope of work with Mike Sweat, Hydrologist with the USGS-WRD Cheyenne office, related to seep and spring monitoring. Last FY, we engaged Mike in a task to prepare a study plan for monitoring seeps and springs monitoring. We are trying to move forward with the concepts lined out in a monitoring protocol. In October Rob Bennetts attended a project review concerning the study plan, in Cheyenne, WY and in November Mike came to Bozeman to flush out the details of a revised study plan. We continue to negotiate and may wish to inquire with other potential partners. The value of seeps and springs as a priority vital sign has recently been discussed in several forums. After discussions with scientists at both YELL and GRTE, it has become apparent that, although seeps and springs are certainly relevant to these parks, that this would not be considered a priority vital sign. The value of seeps and springs as a priority vital sign has also been questioned for BICA, but discussions with several hydrologists and ecologists have convinced us that this is a critical resource for desert environments and that a sufficient number of threats exist to warrant retention of this vital sign as a priority for desert environments (e.g., BICA). The seep and springs vital sign will focus on BICA as seeps and springs have a critical function in the desert environment.

WATER CHEMISTRY

Our objective for this year is to complete a monitoring plan for water chemistry in the Greater Yellowstone Network. Building on the work documented in phase II of the water quality plan, we will conduct workshops and meetings to prepare monitoring objectives. The network will engage in task agreements with water quality experts for their assistance in the development of objectives and monitoring protocols. Once the objectives are flushed out, Rob Bennetts will help complete the water chemistry sampling design. Several protocols exist for water chemistry field methods and we expect to adopt an existing water chemistry field protocol (based on our objectives) and prepare the data management and implementation plans. The network plans to test protocols and scout water quality sampling locations before fully implementing the program in FY05. The protocol narrative and standard operating plans will be compiled by staff and finished by writer/editor. Sue will contribute standard operating procedures and be largely responsible for the 303 (d) monitoring.

CHLORIDE FLUX

The Network plans to aid in chloride flux monitoring already ongoing in Yellowstone by working with the geothermal monitoring plan to outline and complete the needed components for a monitoring plan that can be funded by the Natural Resource Challenge. Current geothermal work is directed by Hank Heasler and completed through collaborations with the USGS and University of Utah in the form of the Yellowstone Volcano Observatory. A Geothermal Monitoring Plan for Yellowstone National Park (Heasler et al. 2003) outlines a strategy and justification for monitoring groundwater, chloride flux, streamflow, and thermal feature geochemistry in Yellowstone. Because information on chloride flux has been collected for the past 19 years (i.e., long-term records available), it is seen as an essential part of monitoring long-term changes in the geothermal system. Threats and issues related to monitoring chloride flux (as cited in the scientific literature) have been collected and synthesized and will be used to make decisions on the role of the Network in this monitoring. It is possible that the Network's major function will be to manage and report on the data already being collected, with possible funding of additional gauging stations. Water samples for chloride analysis are currently collected 28 times a year at river gauging stations

LAND-USE

Our objective for this year is to complete a monitoring plan for land use in the Greater Yellowstone Network. A scope of work and task agreement with Andy Hansen is nearly complete. Land-use monitoring objectives and protocols will have an important role that will permeate through the entire vital signs monitoring program. The scope of work with Andy will be a sequential combination of synthesizing existing information to inform the process of developing monitoring objectives and as such, will necessitate a significant cooperation between NPS and the cooperator to ensure that the monitoring objectives reflect the needs of the GRYN. The task agreement will include the following: 1) Complete, augment, and synthesize existing information on land-use change within the GRYN, 2) Develop conceptual models that will inform how land use change may impact

the ecological “health” of parks within the GRYN and how it “interacts” with other GRYN vital signs, 3) Identify linkages among the monitoring objectives of land-use change and other vital signs so as to enable integration of design elements among vital signs, 4) Using these data in addition to other information (e.g., management issues and threats), develop and refine (through discussions and workshops) specific monitoring objectives for land-use change that are consistent with the needs of the vital signs monitoring program, 5) Develop draft monitoring protocols for land-use change based on monitoring objectives, and in accordance with I & M protocol templates and standards.